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EDITORIAL.

Organic Matter and Nitrogen in Malayan Soils.

The article by R. G. H. Wilshaw on organic matter and nitrogen in Malayan soils, which is included in this issue, forms Part III of the series of Studies in Malayan Soils. Part I of the series was published in the August 1933 number of this Journal and discussed the classification and properties of Malayan soils, while Part II, which appeared in October of the same year, dealt with problems of manuring of inland soils.

The present paper describes experiments which have been carried out to ascertain to what extent the accepted views on the carbon and nitrogen cycles, which take place in soils, can be applied under conditions obtaining in Malaya. The necessity for the proper understanding of the functions of these two elements is obvious, seeing that carbon is primarily concerned with the formation of plant tissue and nitrogen with processes of growth.

Malayan inland soils of the quartzite or granite type are normally deficient in organic matter, which tends to accumulate in soils in which the activity of micro-organisms is curtailed. In Malaya, in general, conditions are ideal for the rapid and complete decomposition of soil organic matter into carbon dioxide, water and simple inorganic nitrogen compounds, and in the soil, practically no formation of what is called "humus" occurs. As a result of the addition of organic matter in the form of green manures, however, there is a rapid production of ammoniacal and nitrate nitrogen which is absorbed by growing plants with a resultant stimulation of growth.

One conclusion of very great practical value which emerges from this paper must be mentioned. The author concludes that, contrary to the view usually held, plants thrive best if green matter is turned in *shortly before planting*. The turning in of a green manure some time before planting results, under the tropical conditions obtaining in Malaya, in the liberation of ammoniacal nitrogen, which under fallow conditions is lost; whereas, under non-fallow conditions, this ammoniacal nitrogen is rapidly changed to nitrate nitrogen and hence is of immediate benefit to the plant which is then at an early stage of growth and therefore likely to respond readily to this supply of plant food.

There are many questions connected with organic matter in soils and the behaviour of green manures, as well as problems relating to the nitrogen cycle particularly under field conditions, which remain unsettled. The article indicates the lines on which future work will be directed as a result of the observations made to-date during the course of the experiments on these complex problems.

The Oil Palm in Sumatra. In May 1933, Mr. J. N. Milsum of the Department of Agriculture S.S. and F.M.S. visited the east coast of Sumatra with the object of studying the recent advances in connexion with the oil palm industry in that country.

The article entitled "The Oil Palm in Sumatra", which is published in the present number of the Journal, gives an outline of some of the more important points of interest observed during his visit, and should form a useful supplement to the information contained in the new edition of the Manual on Oil Palms in Malaya which is about to be published by the Department of Agriculture S.S. and F.M.S.

There is an area of some 155,000 acres under oil palm cultivation in Sumatra, and during the past fifteen years, the area under oil palms in Malaya has increased considerably—from 225 acres in 1917 to 61,000 acres in 1933.

The methods of cultivation adopted appear, on the whole, to be similar in both countries and it is interesting to note that in Sumatra, as in Malaya, the question of manuring with artificial fertilisers is receiving considerable attention. In this connexion, the practice in Sumatra of growing a trial crop of maize on an experimental plot, with the object of assessing the phosphatic requirements of the soil in an area, merits attention.

The importance of using seed of known parentage when planting new areas of oil palms is now well recognised; in Sumatra, where this has been an established practice for a longer period than in Malaya, the results to-date are stated to have justified the care taken in this matter.

Mushroom Culture. The growing of mushrooms is an established industry in many parts of the world, particularly in England, France and America where a species of edible fungus (*Agaricus campestris*) is cultivated on a large scale and finds a ready market. This mushroom also grows wild in the fields during the autumn months, especially following a warm summer, and is much appreciated as an article of diet. In Malaya a species of Agaricus, closely related to *A. campestris,* appears mainly during the months of August and September. This species is well known to European residents in Selangor since it grows on the fairways of the golf course at Kuala Lumpur.

In Europe and America, mushrooms are cultivated in especially constructed houses, or in caves, underground passages, or disused barns, as well as in the open air. Considerable trouble is taken in the preparation of the compost of

which the beds are made. This compost is composed of manure, preferably horse manure, with the addition of straw and soil, and spawn is not added until suitable conditions of temperature and moisture are obtained. The preparation of the compost and the care of the beds requires skill and experience, if remunerative crops are to be secured.

Mushrooms are also grown in China and Japan and are exported mainly in dried form; the species most commonly imported into Malaya is not *Agaricus campestris,* but belongs to a related family—Volvariaceae—and is called *Volvaria volvaceae.*

This species is comparatively rare in the temperate zones and usually grows in hot houses or on beds of tanning bark and similar substrata. It is not, so far as is known, looked upon as an edible fungus in these regions, but in the Eastern tropics it is highly prized by Europeans and Asiatics and considered a delicacy.

In 1916, A. S. Vicencio published a paper, in *The Philippine Agriculturist and Forester,* on mushroom culture (Volvaria) in the Philippines. This was followed in 1921 by a paper by O. A. Reinking and W. H. Brown in a Bulletin of the Bureau of Forestry. A more recent paper by C. van Overeem, in the *Bulletin du Jardin Botanique* 1927—1928, gives an interesting account of the methods employed by the natives in Netherlands India, in the cultivation of Volvaria on rice straw.

Attempts to grow the mushroom *Agaricus campestris* in Malaya from spawn imported from England and Australia have, so far as is known, not met with success, at any rate on the plains. This, however, is only to be expected in view of published statements that the optimum temperature for mushroom beds of this species is 50° to 56° F., the working limits being to 50° to 65° F., and that spawned beds are rendered useless by heating to 72°F. or more for brief periods. A temperature of 72° F. maintained for 24 hours is injurious to spawn, and although the mycelium of the fungus will grow in pure culture up to a temperature of 85° F., a high temperature in the beds encourages other organisms which suppress the growth of mushroom mycelium. It appears probable that, if success in the cultivation of mushrooms is to be obtained in Malaya, a species which will grow in this country should be used, and in this connexion an interesting article by Mr. J. A. Baker is published in the present number of this Journal.

The article describes an experiment in the cultivation of *Volvaria volvaceae* on padi straw at the Bukit Merah Padi Test Station in Province Wellesley, where the success obtained warrants the conclusion that it is probable that mushroom growing would form a profitable accessory industry to padi cultivation.

Original Articles.

STUDIES IN MALAYAN SOILS. PART III

BY

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In Parts I and II of this series, a general account of the characteristics of Malayan soils and the reactions of these to manuring has been given. This paper gives a short account of the accepted views on carbon and nitrogen changes which take place in soils, and describes experiments which have been carried out to ascertain their applicability under Malayan conditions.

Carbon and nitrogen changes which take place in soils are often referred to as cycles. The carbon cycle is concerned with the building up of plant tissues from the carbon dioxide of the air and the decomposition of these tissues under the influence of micro-organisms with the liberation of carbon dioxide again. Similarly, the nitrogen cycle is concerned with the absorption and fixation of nitrogen by plants and micro-organisms and the changes accompanying decomposition. In that carbon may be regarded as the primary element concerned with the formation of tissue, and nitrogen with progress of growth, these two elements merit special study.

This paper concludes with a summary of the position reached with reference to these changes, together with mention of the lines along which future work will be directed.

Short Summary of the accepted views on Carbon and Nitrogen changes in Soils.*

The cycle of nitrogen and carbon changes which take place in soils is dependent on the organic material present.

The organic matter of the soil is a dynamic constituent representing the balance of accumulative over destructive agencies; that is to say, it represents the difference between the rate of addition of plant residues being incorporated with the soil and the destruction of these residues which is being carried out by a variety of micro-organisms. In itself, moreover, it is the source of its own destruction in that it supports this varied microbiological life.

Organic matter accumulates in soils where conditions tend to be anaerobic and temperature low, that is, under conditions where microbiological life is curtailed. Under aerobic conditions and higher temperatures, microbiological

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* The following summary has been freely adapted from 'Soil Conditions and Plant Growth'—E. J. Russell, 1932 Edition.

life increases and decomposition of the organic material proceeds at a higher rate. Under stable conditions, an equilibrium may be reached where decomposition balances accumulation.

The decomposition of plant materials is primarily an oxidation by soil micro-organisms, oxygen being absorbed and carbon dioxide liberated, and is in fact the direct reversal of the process which went on when the plant was originally built up from the carbon dioxide of the air by means of chlorophy. This oxidation process, however, is not complete and a residue is left which in combination with various products, re-synthesised by the micro-organisms in building up their own body substances, gives rise to what is termed humus. Humus, together with the remains of plant material in various stages of decomposition, constitutes soil organic matter.

In this oxidation process, organic substances which have the lowest carbon content such as sugar, starch and cellulose, tend to disappear first, and carbon altogether disappears more quickly than nitrogen; the resultant material in temperate climates usually has a carbon nitrogen ratio of about 10 or 12 to 1.

The micro-organisms which bring these changes about derive their energy for growth from the carbohydrates present, but in order to build up their own body substances, they convert the plant proteins into microbial proteins. If there is any excess nitrogen above that required for their own needs, this is liberated in the form of nitrate. It has been found that one part of nitrogen is immobilised for every 13 to 18 parts of carbon when the soil is acid. If there is any excess of nitrogen in the original material above this amount, it will be liberated as nitrate. If carbon is present in a greater ratio than 12 to 1 to the nitrogen, all the nitrogen present is utilised by the micro-organisms for their own purposes (in the soil they will draw upon any reserves of nitrate that may exist) and the excess carbon is given off as carbon dioxide. Thus, the carbon nitrogen ratio always tends to come back to a fixed value.

Various attempts have been made to follow the course of the decomposition of plant material and the adjoined table shows the general result of the various reactions.

Comparison of Plant Materials with Soil organic matter (Waksman and Tenney).

		Plant Material	Soil organic Matter
Celluloses	...	24.40	3 — 5
Hemicelluloses	...	15.25	5 — 8
Lignin	...	10.30	40 — 50
Protein	...	2.10	30 — 35
Water soluble Protein	...	15.3	Nil

These figures and modern views indicate that, in general, organic material is broken down by means of the rapid decomposition of cellulose and hemi-cellulose, and that lignin is not decomposed but is altered and exists in close association with synthesised proteins.

The final transient but relatively stable product humus has been the subject of much research and it has been found that humus may be split into a number of distinct fractions by treatment with acid and alkali. Reference is made in the experiments to be described later to two such fractions known as alpha and beta humus. These are obtained by differential treatment of an alkaline extract of soil with hydrochloric acid.

All the micro-organisms active in the soil are dependent upon the organic material present, but some of these organisms have specific actions and their activities are associated with a particular compound or compounds.

In general, it may be stated that practically all bacteria and fungi will decompose sugars and starches. The decomposition of cellulose, however, is different: under acid conditions (pH4 or less) it is limited to fungi: above this, from pH 5.5 to 7.0, bacteria are active: under anaerobic conditions decomposition is confined to clostridia.

There are numerous micro-organisms capable of oxidising specific organic compounds which occur in the soil and whilst these are of importance in themselves in that they prevent the accumulation of toxic products, their mention must suffice for the purposes of this account.

Changes which occur in the nitrogen and the micro-organisms associated with these compounds are, however, of great importance. The nitrogen compounds in plant residues added to the soil, break down to form ammonia so long as the ratio of C/N does not exceed 10:1. This change is brought about by various organisms, chiefly *B. Mycoides, B. subtilis, Ps. fluorescens* and *Ps. candatus* and probably enzymes are partly responsible. The ammonia thus produced is changed rapidly into nitrite by the bacteria Nitrosomonas and Nitrosococcus and again rapidly into nitrate by Nitrobacter.

In addition to this change in the form of nitrogen, reverse changes and loss of nitrogen may occur from soils due to denitrification. The conditions necessary are absence of oxygen, the presence of easily oxidisable organic matter, and a reaction between pH 6.4—8.4. The action can be brought about by a large number of micro-organisms.

Happily for agriculture, however, there are various microbiological activities which increase the amount of nitrogen in soils. This increase is obtained from the nitrogen of the air and fixation is brought about by either Clostridia and Azotobacter, free living organisms, or *Bacillus radicicola,* an organism living in symbiosis with leguminous plants.

The total nitrogen content of any soil is, therefore, the balance which exists between these various processes.

It must be remembered that the above views are those which are held in relation to soils of temperate climates. Attention will be drawn in the final remarks of this article to the modifications which must be accepted when applied to the soils of the humid tropics such as Malaya.

Experimental work on Malayan Soils.

The experiments carried out on Malayan soils fall into well defined groups and will be described under the following headings.

I. Pot Experiments on Rates of Nitrification.

II. Loss of Nitrogen by Leaching from Pots treated with Green Cover Crops. The Effect of Azotobacter Innoculation.

III. Decomposition of *Crotalaria usarmoensis* in Pots at normal and sub-normal temperatures. Formation of humus.

IV. Organic Matter Decomposition. Turning in of Fresh Green Covers in the Field.

V. Experiments on the Effect of Turning in of Green Manures on Plant Growth.

Pot Experiments on Rates of Nitrification of Fertilisers.

First Series. A series of pots, each containing 6 kgs. of Raub High Level soil, were set up on 21.4.32. These pots were treated in duplicate with the following fertilisers:—(1) Ammonium phosphate, (2) Urea, (3) Ammonium sulphate, (4) Cyanamide, (5) Cow manure, (6) Control: 120 mg. of nitrogen was added in these forms to each pot, equivalent to a dressing of 40 lbs. of nitrogen per acre.

The pots were kept bare and leaching was carried out at irregular intervals at the rate of 40 c.c. per leaching over a period of thirty-five days.

At the end of this period, figures for the total leachings indicated that nitrification of the added fertilisers was just starting in most of the pots.

The pots treated with ammonium phosphate had given off most nitrate nitrogen in the leachings, 36 mg. compared with control pots 15 mg. This corresponds to 17.5 per cent. nitrification of the added fertiliser. Pots treated with cyanamide and cow manure appeared to have the slowest rate of nitrification.

Ammoniacal nitrogen in the leachings was low, practically negligible, ammonium phosphate pots having given off the highest amount, (1.0 mg.) and control the lowest (0.5 mg.).

When the pots were dismantled and the soil analysed, nitrate nitrogen was highest in the ammonium phosphate, sulphate and urea pots. Ammonia was similar in all.

Second Series. A series of pots was set up on 1.6.32 with similar fertilisers as in Series 1, but Castor cake was also included. Double dressings of fertilisers were given to all pots (240 mg. N_2* per pot) and heavier leaching was carried

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* In order to save space, the symbols or formulae N_2, NO_3 and NH_3 are used for nitrogen, nitrate and ammonia respectively.

out. Leaching was at the rate of about 1000 c.c. per pot every three days for the first $2\frac{1}{2}$ months; subsequently, leaching was carried out once a week only.

Position at end of 44 days.

Leaching of N_2 as nitrate. Controls were lowest, giving off 174 mg. N_2, ammonium sulphate was highest yielding 276 mg. This is an increase of 102 out of 240 mg. added = 42.5 per cent. nitrification.

Castor cake, urea and ammonium phosphate had all liberated about 230 to 240 mg., cow manure and cyanamide about 200 to 210 mg.

Leaching of N_2 as ammonia. Considerable quantities of N_2 in this form were leached out. Controls gave off least, about 25 mg. per pot, varying to ammonium sulphate, the highest, 85 mg. per pot. The loss of N_2 as NH_3 from the control pots corresponds to a loss of 64 lbs. per acre per year.

Total leachings of N_2 (as NH_3 and NO_3) in the ammonium sulphate pots accounts for 102 + 60 = 162 out of 240 mg. of added N_2 = 68 per cent.

Position at the end of 5 months.

These pots were leached continually over a period of five months and finally dismantled on 13.1.33. During this period the N_2 as NH_3 sank practically to nil in the leachings in all cases, whilst the N_2 as NO_3 remained the same for all pots. Over this period the treated pots lost 140 to 150 mg. N_2 as NO_3 as against the control pots about 100 mgs.

Most of the effects, therefore, of the nitrogenous dressings were evidenced within the first period of forty-four days.

The experiment shows that under the existing conditions, nitrification hardly started until a month had elapsed and that eventually this proceeded slowly, with ammonium sulphate nitrifying at a higher rate than other manures.

It also suggests that, under fallow, unmanured conditions, losses amounting to as much as 420 lbs. per acre of N_2 as NO_3 and 60 lbs. per acre of N_2 as NH_3 may occur under heavy leaching conditions over the period of a year.

Third Series. Two series of pots were set up on 2.6.32. Each pot of one series contained 9 kgs. of jungle soil and each pot of the other series, 9 kgs. of an adjacent soil. Both soils were of the quartzite type, and had been lying fallow for some time. These soils were treated with ammonium sulphate, 360 mg. N_2 per pot, (N = 80 lbs. acre) and compared with controls.

Position at end of 42 days.

Leaching of N_2 as NO_3. At the end of this period, in the case of both soils, similar amounts of N_2 had been leached out of all pots, showing that, in this soil, nitrification had not started even after six weeks. Judging by the amount recovered from the control pots (100 mg. from 9 kgs. quartzite soil compared to 175 mg. from 6 kgs. of Raub High Level soil after the same time

in the previous experiments) the quartzite soil has a much lower rate of production of nitrate under normal conditions than Raub High Level soil.

Leaching of N_2 as NH_3. The N_2 leached out in this period shows a very great difference between controls and treated pots. The ammonium sulphate pots gave off 70—90 mg. against control of 8—16 mg.

This fact suggests, as in the previous experiments, that large quantities of nitrogen may be lost from nitrogenous fertilisers in the form of ammonium ion under fallow conditions on some soils in this country within a very short time, owing, apparently, to heavy leaching combined with a slow rate of nitrification and a low absorption capacity or retaining capacity of the soil colloids.

Position at the end of 6 months.

These leachings were continued until January, 1933, by the end of which time the total amounts of N_2 as NO_3 recovered in the leachings were as under.

		mgs.
Jungle soil + Ammonium sulphate	...	180
Jungle soil alone	...	170
Cleared soil + Ammonium sulphate	...	142
Cleared soil alone	...	150

On the other hand, the amount of N_2 as NH_3 recovered in the leachings was negligible—the value for all pots having fallen practically to nil at the end at the first six weeks and remaining there throughout.

As the difference in N_2 as NH_3 recovery at that time between controls and treated pots was 70 mg. and practically no further difference has been shown since, either in N as NH_3 or NO_3, it appears as if either 360—70 mg.—*i.e.* nearly 300 mg. of N_2 have been absorbed by the soil in some insoluble form, or else lost as gaseous nitrogen.

Loss of Nitrogen by Leaching from Pots Treated with Green Cover Crop (crotalaria usaramoensis) and Starch. The effect of Azotobacter Inoculation on Nitrogen Fixation.

A series of 24 pots was set up on 26.2.32, filled with 6 kgs. each of Raub High Level soil. Two series were arranged, limed and unlimed, half of each series being heavily inoculated with Azotobacter. Each series contained 12 pots of which four pots were treated with :—(*a*) cover crop—240 grams per pot equivalent to 40 tons per acre ;—(*b*) four with starch—100 grams per pot (carbon to correspond to carbon in cover crop) ; (*c*) four controls.

These pots were leached weekly for the first five months, then fortnightly, at a rate of 600 c.c. of leachings per pot.

Loss of N_2 as NO_3 in Leachings. Up to a period of 20 weeks, the addition of starch depressed the leaching of N_2 completely in all cases. At the end of this period, a small amount was beginning to be recovered in the leachings.

Controls gave off a steady low amount, about 4 mg. per week on an average for the unlimed series and slightly higher for the limed series.

The pots, into which the cover had been turned, showed a sharp rise in the amounts leached out at the end of the fifth week. This was followed by a gradual decline until it reached the rate of the controls about the end of the seventh week.

The leachings from the limed plots were higher than from the unlimed.

At the end of seventeen weeks the position may be summarised as under :—

	mgs. of N_2 as NO_3 recovered in leachings		
	Limed	Unlimed	
Control ...	164	70	Inoculated
Cover ...	426	290	Inoculated
Starch ...	Nil	Nil	Inoculated
Control ...	116	67	Uninoculated
Cover ...	402	301	Uninoculated
Starch ...	Nil	Nil	Uninoculated

Loss of N_2 as NH_3 in Leachings. Over the period of twenty weeks, controls and starch-treated pots gave off a negligible amount of N_2 .

In the case of the pots with covers turned in, there was a sharp rise at the end of the third week which gradually declined to a negligible amount again by the end of the eighth week.

This sudden ammonia production, most probably from the readily decomposable protein matter in the green tissue, is reflected in the high rate of production of N_2 as NO_3 which was observed starting at the end of the fifth week. As on previous occasions, the limed plots liberated a larger amount of N_2 as NH_3 than the unlimed. The effect of lime would appear to be one of stimulation of the population of micro-organisms. Whether it is to be attributed to the presence of calcium ion, depression of hydrogen ion, or neutralisation of acidic toxic products is not known.

Position after 41 weeks.

Loss of N_2 as NO_3 in Leachings. As mentioned above, towards the end of twenty weeks the starch-treated pots commenced to lose N_2 in the leachings. This continued until at the end of a further period of twenty-four weeks the rate was practically the same as that of the controls. Pots treated with crotalaria still had a higher output of N_2 than the others and the effect of lime still influenced the figures slightly. No effect was attributable to inoculation.

During the period from the seventh week until the forty-first week the losses may be tabulated as under :—

	mg. N_2 as NO_3		
	Limed	Unlimed	
Control ...	91	63	Inoculated
Cover ...	141	116	Inoculated
Starch ...	85	25	Inoculated
Control ...	70	48	Uninoculated
Cover ...	134	111	Uninoculated
Starch ...	75	40	Uninoculated

These in combination with the previous figures for losses give totals over a period of forty-one weeks from the start as under :—

		mg. N_2 as NO_3 Limed	Unlimed	
Control	...	302	189	Inoculated
Cover	...	646	515	
Starch	...	98	29	
Control	...	239	155	Uninoculated
Cover	...	660	514	
Starch	...	82	41	

Loss of N_2 as NH_3 in Leachings. Over the whole period from the seventeenth to forty-first week, the amounts recovered in the leachings were negligible, in all cases the total being about 1 mg. from any one pot.

Total Nitrogen content of the Soils.

The soils in these pots started with a total nitrogen content (Kejldahl) of 0.170 per cent. At the time of the first period of seventeen weeks this had dropped to 0.105 per cent.

For those pots containing 6 kgs. of soil, this corresponds to a total difference of 3900 mg. of nitrogen.

The amounts of nitrogen leached out in the form of ammonium salts and nitrates up to this time has a maximum value of less than 500 mg.

Periodic determinations of nitrogen by the Kejldahl method were carried out on the leachings and figures obtained show an average loss of about 5 mgs. of nitrogen and 50 mg. of carbon from control and cover crop pots over a period of fifty weeks. Some of the starch pots, however, gave figures showing twenty time this amount. This point requires further investigation, especially in view of the recent theory advanced by Vageler that, in non-calcareous tropical soils, nitrogen is lost as soluble humates.

Taking the maximum amount thus lost, however, the total nitrogen losses accounted for is scarcely 50 mg. There remains, therefore, 3400 mg. of nitrogen unaccounted for. The most likely explanation of this enormous loss is that it occurs in the form of gaseous nitrogen.

This theory seems tenable especially in view of figures obtained at the end of forty-one weeks. By this time, the total nitrogen content of the pots, whilst showing slight variation between themselves, gave an average value of 0.121 per cent., showing that nitrogen recuperation was setting in. It seems likely that the aeration given to the soils in filling the pots caused heavy destruction of the organic nitrogen compounds of this soil to proceed, and that now that the soil has settled in the pots, equilibrium is once more being brought about.

Loss of Nitrogen as NO_3 and NH_3 from Pots treated with Green Cover Crop and Starch, and carrying a growth of Grass.

In view of the large losses of nitrogen obtained in Experiment II, a further extension of this was started in September, 1932. In this case, no inoculation with Azotobacter was carried out, but the pots all carried a growth of grass. In other respects the lay-out was similar. The grass was cropped periodically and the nitrogen thus removed was determined.

The experiment consisted of 12 pots of Raub High Level soil from the Government Experimental Plantation, Serdang, each containing 6 kgs. of soil. Six of these received a dressing of lime. Cross dressings were cover crop turned in, starch turned in, and controls as in the previous experiment. The fresh cover contained 1.07 per cent. N_2.

Grass was planted on 27.9.32.

In the first leachings taken on 10.10.32, very large amounts of N_2 as NH_3 were recovered from the pots treated with the cover crop—100 mg. in the case of the limed soil and 60 mg. in the unlimed. Nitrates were low. These values for N_2 as NH_3 fell gradually to practically nil at the end of eight weeks whilst the N_2 as NO_3 gradually increased. During this period, control pots and starch pots, after a preliminary small amount of N_2 as NH_3, gave nil values for nitrogen as both NO_3 and NH_3.

At the end of fifteen weeks these conditions still obtained.

This shows quite clearly and definitely, therefore, that the presence of a growing cover enables all N_2 as NO_3 to be absorbed under normal conditions and that, although after a dressing of green manure there is such a rapid decomposition of readily soluble proteins that quantities of ammonia may escape by leachings, the crop soon reduces this excess. As was expected, the crops of grass reaped were best on the cover-treated pots and worst on the starch—the activities of the organisms in decomposing this rendering all nitrate unavailable for the growing plant.

The relative crops produced may be seen from a comparison of the N_2 figures for the grass-croped. The percentage N_2 in the grass was practically the same for all pots.

Total mg. N_2 recovered in crops at end of 15 weeks
(Averages)

		Limed	Unlimed
Control	...	180	122
Cover	...	660	650
Starch	...	94	80

mg. N_2 as NO_3 recovered in leachings.

		Limed	Unlimed
Control	...	16	11
Cover	...	78	65
Starch	...	Nil	Nil

mg. N_2 as NH_3 recovered in leachings.

		Limed	Unlimed
Control	...	16	16
Cover	...	153	140
Starch	...	3	3

The sudden rise and fall in ammonia figures and the manner in which nitrate is absorbed by the growing plant is best shewn by the following tables :—

mg. N_2 as NH_3 recovered in leachings.

Treatment	10/10.32	10/24.32	11/7.32	11/21.32	12/5.32	12/19.32	1/9.33
Control	11.5	1.1	0.3	0.3	0.4	Nil	0.2
Control	13.8	3.3	0.3	0.3	0.2	Nil	0.2
Cover	92.0	51.75	2.3	0.8	0.1	Nil	0.2
Cover	103.5	51.75	3.4	0.8	Nil	Nil	0.2
Starch	2.3	1.1	0.4	0.2	0.1	Nil	0.3
Starch	1.1	0.6	0.3	0.3	Nil	Nil	Nil

mg. N_2 as NO_3 recovered in leachings.

Treatment	10/10.32	10/24.32	11/7.32	11/21.32	12/5.32	12/19.32	1/9.33
Control	16.5	Nil	Nil	Nil	Nil	Nil	Nil
Control	16.5	3.3	Nil	Nil	Nil	Nil	Nil
Cover	2.8	20.7	20.7	20.7	6.7	5.6	Nil
Cover	2.8	13.8	20.7	20.7	11.1	9.2	Nil
Starch	Nil	0.5	Nil	Nil	Nil	Nil	Nil
Starch	Nil	Nil	Nil	Nil	Nil	Nil	Nil

Decomposition of Crotalaria Usaramoensis in Pots at Normal and Sub-normal Temperatures. Formation of Humus.

On 31.3.32, 12 pots were set up, each containing 28 kgs. of Raub High Level soil. 560 gms. of fresh Crotalaria were turned in to each pot, corresponding to a field dressing of 20 tons per acre. 6 pots were limed at the rate

of 2 tons per acre—6 unlimed. 2 pots, one limed and one unlimed, were set aside under normal temperature conditions and kept water-logged.

2 limed and 2 unlimed pots were placed in a 'cold storage' box at an average temperature of 75°F—the remaining pots were exposed in the open.

All the pots (excepting those water-logged) were leached weekly to about 600 c.c. and N_2 as NH_3 and NO_3 determined in the leachings. The fresh cover turned in contained 1.2 per cent. nitrogen.

Nitrogen as NO_3 and NH_3 recovered in Leachings.
Position at end of 15 weeks.

	N_2 as	Limed	Unlimed
Normal Temperature	Nitrates	770 mg.	485 mg.
	Ammonia	17 mg.	70 mg.
		787 mg.	555 mg.
Sub-normal Temperature	Nitrates	87	89
	Ammonia	85	118
		172	207

It is assumed that decomposition in the unlimed pots at normal temperature is proceeding in a normal manner. At normal temperatures, therefore, the effect of lime has been to increase the liberation of N_2 as NO_3 and to depress the amount of N_2 as NH_3. This indicates a very rapid change of nitrogen from the protein form to the nitrate form.

At sub-normal temperatures, it would appear that the activity of the nitrifying bacteria has been reduced practically to a standstill: hence we can look for no effect from liming and no effect is in evidence. The figures for total N_2 recovered, (172 mg.) compared with 787 mg. or 555 mg. with 207 mg., indicate to what extent microbiological activity has been curtailed.

The ammonia nitrogen recovered is higher in the pots at sub-normal temperature, but this does not indicate any greater activity of the ammonifying bacteria, since the low figures for the normal pots are merely an indication of the rapid change to nitrate.

At the end of this period (fifteen weeks) nitrate was commencing to be liberated from the pots kept at reduced temperature, which would show that the inhibiting effect on the microbiological life was beginning to wear off and that the population was becoming acclimatised to the new environmental conditions.

Over the period of the next sixteen weeks, the leachings given off by these pots were as tabulated beneath.

	N_2 as	Limed	Unlimed
Normal Temperature	Nitrates	460 mg.	455 mg.
	Ammonia	Nil	Nil
		460 mg.	455 mg.
Sub-normal Temperature	Nitrates	370	368
	Ammonia	40	45
		410	413

As was anticipated, the amount of N_2 as NO_3 from the pots at reduced temperature gradually increased until the figures were practically the same as those for the normal temperature pots, showing that the microbiological life had become acclimatised to the new conditions.

The effect of the lime dressing would appear to have worn off completely.

It is interesting to note that slight ammoniacal nitrogen losses persist in the soils at lower temperature, but the total loss of nitrogen over the period is approximately the same for all pots.

At the end of this period—thirty-one weeks from the start—a fresh dressing of *Crotalaria usaramoensis* was turned into the pots at the lower temperature, followed six weeks later by a fresh dressing into the pots at normal temperature.

No immediate effect of these dressings became apparent in the case of pots at sub-normal temperatures, as reflected by the figures for nitrogen in the leachings, and at the end of the period under review (forty-three weeks) the amounts of N_2 as NO_3 and NH_3 were similar to those obtained towards the end of the thirtieth week.

In the case of the pots at normal temperature, increased nitrate nitrogen figures were obtained starting about six weeks after turning in of the cover.

Humus Determinations.

Humus determinations carried out at intervals over this period showed small fluctuations in the quantities of alpha humus extracted. Figures for beta humus, however, showed a steady slight upward trend as is indicated by the table on page 16.

Organic Matter Decomposition: Turning in of Fresh Green Covers in the Field.

Plots at the Government Experimental Plantation, Serdang, growing the following covers, were utilised for this experiment:—

(*a*) Mixed legumes—*Pueraria phaseolus* and *Centrosema pubescens.*
(*b*) Upright legume—*Tephrosia toxicana.*
(*c*) Non-legume—*Mikania scandens.*
(*d*) Bare.

of 2 tons per acre—6 unlimed. 2 pots, one limed and one unlimed, were set aside under normal temperature conditions and kept water-logged.

2 limed and 2 unlimed pots were placed in a 'cold storage' box at an average temperature of 75°F—the remaining pots were exposed in the open.

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(*c*) Non-legume—*Mikania scandens.*
(*d*) Bare.

Quantities in grams of beta humus extracted from 50 gms. dry soil

	Start 30.3.32	21.4.32	23.5.32	22.8.32	4.10.32
Normal Temperatures					
Limed	5.35	6.25	7.05	7.2	6.9
Unlimed	5.35	6.45	6.3	6.6	7.3
Sub-normal					
Limed	5.22	6.6	6.3	6.72	6.95
Unlimed	5.22	5.8	6.25	6.8	7.1

All plots were divided longitudinally into two, and one half of each was allowed to remain untouched. In the case of (*a*) and (*c*), the cover on the other half was cut and turned in. In the case of (*b*), the cover was not cut but the ground was cultivated, and in the case of (*d*) it was forked.

Circular glazed earthenware pots about 1 ft. deep and of similar diameter were sunk flush with the ground in the centre of each sub-plot and a wire cage containing about 6 in. of the top soil was placed in the top of each pot in order that the leachings might be collected.

Soil thermometers were sunk in both halves of plots (*a*) and the untouched half of plot (*d*).

The following analyses and determinations were carried out at weekly intervals on samples from each of the 8 sub-plots :—

On the soil:

Moisture
Nitrate
Ammonia
Total Carbon and Nitrogen
A and B humus
Carbon and Nitrogen content of each humus and loss on ignition
Residual Carbon and Nitrogen from alkali extract.

On the leachings.

Volume; pH; N_2 as NO_3.

Temperatures were recorded at 6 in. depth daily.

Preliminary analyses of the soil were carried out just previous to turning in of the cover crops. The cover crops themselves were also analysed, and gave the following results :—

PERCENTAGE COMPOSITION OVEN DRY BASIS.

	Mixed Legumes	Non-Legume
Ether soluble ...	3.42	6.6
Water soluble ...	17.50	26.8
Alcohol soluble ...	3.03	3.9
Hemi-celluloses ...	15.40	12.0
Celluloses ...	19.60	12.1
Lignin ...	12.60	11.5
Water insoluble protein ...	13.40	12.25
Total Ash ...	6.70	10.25
	91.65	95.40
Total Carbon ...	47.9	45.3
Total Nitrogen ...	3.22	2.62
Ratio C/N ...	15 :1	18 :1

FRESH MATERIALS.

Moisture ...	66.93	85.31
Loss on Ignition ...	30.85	13.18
Ash ...	2.22	1.51
	100.00	100.00
Total Carbon ...	15.81	6.67
Total Nitrogen ...	1.06	0.385

These covers were turned in on 27.11.31 at the estimated rate of 1000 lbs. per acre on Plot (*a*) and 3000 lbs. per acre on Plot (*c*). As each sub-plot was ⅛th. acre, the amounts added were 130 lbs. and 400 lbs. respectively. Analyses were carried out for a period of 7 weeks.

Results.

(1) *Soil Temperatures at 6 ins. below the Surface.* Soil temperatures over a period of twenty-eight days ranged from 80°F to 83°F on the bare plot (*d*). On plot (*a*) on the half into which the cover had been turned, the range was from 79° to 82°F; in practically all cases being 1° lower than the bare plot on any occasion. On the half on which the cover was still growing, the range was from 78° to 80°F—this again on any occasion being 1° lower than the other half of the plot and 2° lower than the bare plot.

A fall of 2 ins. rain in one day, the maximum which fell over the period, produced an effective drop of temperature of 1° only on all of the plots.

(2) *Nitrates and Ammonia in the Soil.* In the case of all eight sub-plots, ammonia in the soil showed very small variation over the period of seven weeks,

remaining throughout in every instance between 8 and 12 parts per million (p.p.m.).

In the case of the untouched halves of every plot, nitrates remained practically constant, varying from 0.0—1 p.p.m., except for the bare plot which, starting with nitrate content of 5 p.p.m., rose to 10 p.p.m. and fell again.

In the case of the treated halves of the plots in plots (*b*), (*c*) and (*d*) there was a steady rise in all cases from 0.0 p.p.m. to about 4 p.p.m. after a period of three weeks which died away to nil again at the end of seven weeks.

Only in the case of the mixed legumes turned in was there any marked rise in nitrate content; on this sub-plot, the nitrate figures rose sharply from nil to 20 p.p.m. after three weeks and continued at this height for the next four weeks.

(3) *A Humus.* This portion of the humus fraction fluctuated slightly in amount over the period, but the general trend appeared to be a loss during the first two or three weeks on the plots into which green cover had been turned, (*a*) and (*c*), and was more particularly noted on plot (*c*)—the non-legume. This initial drop was followed by a rise again until at the end of seven weeks the original level had been regained.

The composition of the product A humus remained constant.

(4) *B Humus.* The figures obtained for the amounts of B humus fluctuated wildly from week to week, but it might be suggested from them that there was a rise in value where cover had been turned in after about the end of the fourth week.

The extent of the fluctuations, however, is too great for any definite conclusion to be drawn from the figures.

(5) *Total Carbon and Nitrogen.* The figures for total carbon and nitrogen fluctuated throughout the period, but there were no definite signs of either a loss or gain in total nitrogen or carbon. This is only to be expected when consideration is paid to the small amounts of green matter added.

It is noteworthy that these figures for the bare plot, both before the experiment began and throughout, are lower for carbon than the figures for those plots which had had cover growing in them for some seasons; the amount is small but definite. Cover crop plots contain about 1.8 to 2.0 per cent. carbon and the bare plot 1.5 to 1.8 per cent. carbon.

This experiment was continued throughout 1932, occasional samples being taken for analysis. At the start of the wet season, the existing covers were turned in and fresh seed planted. Analyses, up to the present date, indicate that there is possibly a very small increase occurring in the amount of A humus extracted from the soils in which covers have been turned in. It is difficult to cite individual figures, as fluctuations within wide limits occur, but the trend may exist.

Total carbon and nitrogen figures, for samples taken throughout the year, show a very considerable drop in the month of April followed by subsequent rises and falls. These fluctuations occur in all the soils. The maximum drop

in nitrogen content is from 160 mg. per 100 gr. to 60 mg. per 100 gm. and indicates large losses of gaseous nitrogen.

This point is subsequently further discussed.

Experiments on the Effect of Turning in of Green Manures on Plant Growth.

A. A series of 12 pots were set up in February, 1932, each containing 6 kgs. of Raub High Level soil. At weekly intervals, 1 per cent. by weight of *Crotalaria usaramoensis* leaves (10 tons/acre) were added to individual pots. One week after the addition to the twelfth pot, maize was planted in all, together with a basic dressing of basic slag (50 lbs./acre P_2O_5).

Owing to inferior seed, germination failed, but the pots were successfully replanted a week later.

The growth of the maize was best in the pots in which the green manure had been turned in, one to four weeks prior to planting.

It would appear that more beneficial effects are derived by planting up within a short time of turning in a cover crop, rather than by allowing the green material to rot down.

B. Further, to test the conclusion reached in the previous experiment, 6 pots of Serdang Black soil were used to compare the effect on growth of rotted grass and fresh grass turned into the soil.

Two pots were treated with a dressing of well-rotted grass, two with fresh grass and two controls.

Maize was planted, and the subsequent growth observed. The difference in growth was very marked and further substantiates the conclusion reached previously that fresh green matter turned into the soil exerts its greatest beneficial effect if planting takes place almost immediately.

C. An experiment was started in October 1932, to compare the fertility of jungle soils and cleared soils, and to determine the influence of jungle mulch.

6 pots were set up containing 24 kgs. each of fresh quartzite jungle soil, and 6 pots containing 24 kgs. of quartzite soil which had been cleared of jungle for some years. To three pots of each series was added about 1½ kgs. of fresh jungle mulch, laid on the top of the soil in imitation of jungle conditions. The remaining 3 pots of each series remained with a cleared surface.

Subsequent growth of maize was best in all the pots with the jungle mulch added, the jungle soil with the jungle mulch being very slightly better than the other soil with jungle mulch.

Maize in the pots without mulch, whether on jungle or cleared soil, made markedly worse growth.

From this experiment it would appear that the fertility of fresh jungle soils is due in some manner to its covering mulch rather than any particular property of the soil *per se.* This effect of mulch may be due to its protective

action on the soil, or to nutrient material liberated on breakdown or, in practice, on burning.

D. In order to test out this conclusion, a further experiment was devised in which the effect of this jungle mulch could be determined. In combination with this, information was sought on the effect of 'burn' on soil.

A series of 30 pots, the treatments in triplicate, was set up with quartzite soil.

The treatments were as follows :—

1. Top 3 ins. of soil heated to 75°C.
2. do. do. 100°C.
3. do. do. 150°C.
4. do. do. 200°C.
5. do. do. 250°C.
6. do. do. 300°C.
7. do. do. 350°C.
8. do. do. 400°C.
9. Soil covered with 2 ins. of artificial mulch of torn paper.
10. Soil covered with burnt forest mulch.

It was hoped that this would indicate whether the beneficial effect of jungle mulch was due to its protective action or its chemical composition, and further, in the case of a burn, whether or not the action was one of partial sterilisation of the soil.

The pots were planted with maize and at the end of six weeks the position was as follows. The maize in treatment 10 had made best growth—closely followed by treatment 9. Treatments 5—8 were very much inferior whilst treatments 1—4 were slightly better than this, but not as good as treatments 9 or 10. Growth in all cases, however, was bad and the plants were weedy and straggly, although originally they showed much greater promise.

This experiment indicates that the effect of jungle mulch is probably both protective and chemical and that the main effect of a burn is one of liberation of chemical products for plant nutrition rather than partial sterilisation. Growth was, however, so poor that further work is required before definite conclusions can be drawn.

General Considerations.

The Nitrogen Problem.

Total Nitrogen Content of Soils.

In the latest of a series of papers on nitrogen recuperation in the soils of the Bombay Presidency, Sahasrabuddhe and Kanitkar* have summarised their views to date on the results of their experiments and state that definite recuperation of nitrogen takes place in these soils under field conditions; that

* *Indian Journal of Agricultural Science*, Volume II, Part V, October, 1932.

the addition of organic matter in the form of farmyard manure or green manure increases the recuperative power of the soil, and that, over a period of one year, from month to month the nitrogen content of the soil is not a stable or a constant quantity. With regard to these conclusions, it should be pointed out that the soils they are dealing with have an average nitrogen content of about 100 mg./100 gm. soil or 0.010 per cent. N_2—and that their findings are based on analytical data which are obtained from 20 grams of air dry soil by means of Kejldahl determinations.

Experiments in this laboratory on 5 gms. samples of air dry soil indicate that a single Kejldahl determination of the N_2 content of an air dry soil is liable to a 10 per cent. sampling error. A mean of duplicates, therefore, will have an error of about 7 per cent. Some of the conclusions reached in their earlier paper are based upon differences in nitrogen content which lie within this error.

The results of their month to month determination of total nitrogen, however, show much greater nitrogen variation than could possibly be accounted for by experimental or sampling error, the range of fluctuation being from 70 to 130 mg. of N_2 per 100 gm. soil.

The conclusion that the total nitrogen content of soils is not a stable or a constant quantity is borne out by the results of these pot experiments on the loss of nitrogen by leaching and also by the figures obtained in the field from Block XIV at Serdang. Here spasmodic sampling showed a drop of from 170 to 60 mg. per 100 gm. soil in these plots during the period January to April 1932—with a subsequent rise and final figure at the end of the year of about 100 mg. per 100 gms. soil.

Ignoring the possibility of sampling error, results have been obtained which would also support the further conclusion, that the addition of a green manure has aided the recuperative power of the soil.

However, these results, in combination with accidental observations obtained from experiments designed for other purposes, all tend to show that the total nitrogen content of Malayan soil is subject to great fluctuation.

Many Malayan soils contain nearly as much nitrogen and carbon in the sub-soil as in the top soil.

The evidence from pot experiments has shown that, undoubtedly, soluble nitrogen and carbon is being washed through. Vageler has suggested that, in non-calcareous tropical soils, nitrogen may be lost as soluble humate. It is a reasonable hypothesis, therefore, that the high nitrogen and carbon content of some sub-soils may be due to the gradual storage by long accumulation from these soluble humates being washed downwards.

But, as has been pointed out previously, the fluctuations which have been found to occur in total nitrogen content are far too great to be accounted for by loss as soluble humate.

One is forced to the conclusion that these enormous losses are mainly in the form of gaseous nitrogen. To counteract these losses, however, large

recoveries are taking place, producing the fluctuations observed. This can only mean that rapid fixation is occurring at certain seasons.

Mr. R. A. Altson, Assistant Mycologist of this Department, has isolated Azotobacter from typical Malayan soils, and has shown that such isolations are capable of fixing nitrogen in culture; and though it has not yet been demonstrated that this function is performed in the soil, it is possible that any fixation which may have taken place in the experiments so far conducted has been masked by rapid denitrification. Clostridium was found to be present in most of the soils which he examined.

Nitrogen as Nitrate and Ammonia.

An examination of the literature on laboratory experiments bearing on the problem of nitrification in soils has shown that, in the majority of instances, the dressings of nitrogenous fertilisers added have been excessively heavy, and in few cases only has the rate of application being comparable with field dressings—*i.e.* a rate of 1—2 cwt. per acre of fertiliser equivalent to say 40 lbs. nitrogen per acre.

Excessively heavy dressings are liable to upset the normal sequence of changes which would occur in the field and as a consequence, therefore, experiments as carried out in this laboratory have all been with normal rates of application of manures.

Unfortunately, this means that natural fluctuation and experimental errors are comparable with the effects to be looked for from any nitrogenous dressing—and some experiments have, in consequence, given negative results.

One or two definite indications, however, have emerged. It would appear that maximum nitrate nitrogen accumulation occurs at a period of four to six weeks after application of a dressing; further, if any excess of nitrogen occurs in the soil as ammonia, this is very liable to be lost in drainage instead of being held by the colloidal complexes in the soil as has been shown to occur in other countries.

The Organic Matter Problem.

In view of the remarks so frequently read and heard in Malaya, that the turning in of a green manure into the soil increases the 'humus' of the soil, (with no definite indications of what is meant by humus), experiments have been carried out to determine, as far as possible, what is the fate of covers turned into soils, and what their effect is on the soils.

Conditions in Malaya are practically ideal for the complete and rapid oxidation of organic matter to carbon dioxide, ammonia and water by micro-organisms, there being a high temperature and plenty of moisture, although admittedly calcium carbonate is lacking.

In addition to this process of complete oxidation to carbon dioxide, ammonia and water, there exists in nature the process of humification whereby some part

of the added organic matter is not completely destroyed, but survives in an altered form as a dark-coloured amorphous material which is known as humus.

Humification may occur in three ways—

(1) Anaerobic humification
(2) Acid humification
(3) Humification under semi-arid condition.

Anaerobic humification occurs in ponds and lakes under water-logged conditions and it is this type of humification which probably accounts for the belts of coastal peat formed in Malaya.

Acid humification occurs where organic matter is decomposing in the absence of calcium and other bases, as is exemplified by the production of acid peat under heath or conifer forest conditions. In this case, the peaty organic matter accumulates as a sharply defined layer at the surface. The peat found in patches on the hills of Malaya may have been formed in this manner.

Humification under semi-arid conditions, as is exemplified by the black earth soils of Russia, occurs where there is a deficient rainfall but a high content of calcium and other bases which prevents the formation of an acid peat.

On the plains of Malaya, on free draining soils—which are in the majority—none of these three conditions are satisfied. The position we reach, therefore, is that no conditions exist which are known to be suitable to the formation of humus and that conditions are practically ideal for the rapid and complete destruction of organic matter to carbon dioxide and water. The natural inference therefore is that no humus will be formed in these soils.

In practice, it is found that a normal inland soil of Malaya of the quartzite or granite type has a total organic matter content of about 6 per cent. as compared with figures for English soils of from 10 per cent. to 20 per cent. This being the total organic matter content, the possible amount of humus present is very small indeed.

The results of experiments described this year have shown that where covers have been turned into the soil, the amount of humus (alpha and beta) subsequently extracted shows no real increase.

It is clear that there is no lack of microbiological life in Malayan soils since, even in the absence of added organic material, nitrification proceeds normally, and as has been mentioned, at times rapid fixation must occur.

Green matter added to Malayan soils clearly, therefore, does not fulfil its usual role in the formation of humus. It is possible, however, that humus may be formed, and, according to Vageler's theories, be immediately lost in soluble form in the drainage waters; but there appears a more likely explanation.

If we examine the results obtained in this experimental work, it will be noted that the turning in of green manures has been accompanied in all cases by a great stimulation of growth. Observations have shown that immediately after turning in, rapid production of ammoniacal and nitrate nitrogen occurs, extending over a period of six to eight weeks, and that this production is

absorbed by growing plants. It seems abundantly clear, therefore, that intensive and rapid destruction of the organic material is taking place with the liberation of carbon dioxide, water and ammonia and that this destruction extends to practically the whole of the plant tissues, the amount of humus formed being negligible.

Herein, too, possibly lies the explanation of the fact that plants thrive best if green matter is turned in only shortly before planting. The view is usually held that the turning in of a green manure immediately prior to planting is disadvantageous because the rapid decomposition of the excess of carbohydrates which takes place uses all the reserves of nitrogen from the soil so that none is available for the plant. So far from this being the case, the experiments carried out under fallow conditions show that there is actually an excess of ammoniacal nitrogen liberated in the soil. Under non-fallow conditions, this ammoniacal nitrogen is rapidly changed to nitrate nitrogen and hence is of immediate benefit to the plant. The plant receives the benefit of a good nitrate supply at an early stage of growth : this lasts as long as there is readily decomposable protein matter still extant in the cover turned in.

Further, it must not be forgotten that this rapid destruction is accompanied by a large evolution of carbon dioxide and there is evidence from numerous workers of this constituting a form of fertilization.

There remains, however, a point raised in Part II of this series. Why should the benefits conferred outlast the period of rapid decomposition if these benefits are attributable only to the nitrate supply and possibly the fertilization value of carbon dioxide? Two suggestions are there mentioned, either that the formation of iron humate renders iron available, or that an increase of available nutrients is obtained by the acceleration of mineral decomposition.

These questions and suggestions in themselves indicate the lines along which future work will be directed.

MUSHROOM GROWING IN PROVINCE WELLESLEY & PENANG

BY

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The cultivation of mushrooms is a recent innovation in the Malay Peninsula though it is said to be practised fairly extensively in Netherlands India. The initiative in Malaya was taken by a few Chinese in Penang who introduced spawn from China in April 1932 and have since carried on a small, though profitable industry, at Sungei Nibong and at Genting. A trial mushroom bed was started at Bukit Merah Padi Test Station in May 1933, and the results so far obtained have been encouraging.

The fungus in question was identified by the Mycologist as *Volvaria volvaceae,* which is the principal species cultivated in Netherlands India. It is a large pileate fungus with a dark grey-coloured cap, some three inches in diameter when fully expanded. It appears as a small "button" completely surrounded by a rather thick volva which persists until the fungus is about one-third its full size. It has no annulus. Figure 1.

For purposes of cultvation, the only essential factors are an abundance of padi straw and an adequate supply of water. The straw needs to be spread out and carefully picked over, all the leaves being removed, so that only the haulms remain. These are then made into small bundles or sheaves and are soaked in water for two days. While they are soaking they should be trodden from time to time to render them soft and pliable. A low earth bed (say 16 feet x 3½ feet) is then constructed to a height of twelve inches and a layer of spawn is distributed evenly around the edges. Over the spawn, sheaves of straw are laid crossways to form a continuous layer. The length of the straw is usually such that one end must be bent back so that the haulms fit the breadth of the bed. When the next layer is applied the opposite ends are bent in the same way so that the surface remains approximately level.

The third layer of sheaves is laid lengthwise, instead of crosswise, and water is poured over the surface. The mass is then pressed down, to consolidate it as far as possible, and another layer of spawn applied. This process is repeated. After the third application of spawn, the same arrangement is followed, with the addition of a kind of thatch, in which the sheaves are made to slope upwards towards the middle, and the bed is completed by spreading a thin layer of haulms right over it from side to side.

Copious supplies of water must be given with the construction of each successive layer. Such a bed would be about four feet high (though it subsides somewhat with age) and would present in section, the appearance shown in Fig. 2.

It is convenient to surround the bed by a shallow ditch from which water can be readily obtained later. For a bed of 16 ft. x 3½ ft. x 4 ft. one bag of spawn containing twenty-five gantangs (Imperial gallons) is regarded as sufficient.

According to Chinese growers, no further watering should be done for a week after the spawn has been sown, though the validity of this statement remains to be tested. At the end of this period, however, water must be poured over the bed twice daily, morning and afternoon.

At Bukit Merah, the first mushrooms were harvested 25 days after the spawn had been sown. Their appearance followed two days of heavy rainfall.

Under favourable conditions 1—2 kati* of fresh mushrooms per day may be obtained from a bed of the dimensions given above, though periods of dry weather reduce the yield or, if prolonged, may suspend it altogether until there is further rainfall. In this connexion, it may be noted that watering, as ordinarily practised, does not appear to offer an effective substitute for rainfall though it would presumably do so if the water were applied in sufficient quantity or over a sufficient period of time. After a few weeks, the internal temperature of the bed is about 45°C at six inches from the surface and 50°C at a depth of one foot. Later the temperature gradually decreases.

The mushrooms are preferably picked in the "button" state (*i.e.*, before the volva has broken) and eaten fresh. If, however, it is desired to keep them they may be dried over a charcoal fire. For this purpose, the apparatus shown in Figure 5 is used. It consists simply of a broad basketwork cylinder made from bamboo, within which a removable platform of the same material is supported by two horizontal wires fixed at right angles across the cylinder. The charcoal fire is made in an iron pan and placed under the platform. The drying process takes about twelve hours.

When fully dried, the mushrooms may be kept almost indefinitely provided that they are stored in air-tight tins, such as that shown in Figure 6. If the tin is not air-tight, the mushrooms tend to acquire a rather unpleasant smell which, however, disappears to a large extent on cooking. Eight to nine kati of fresh mushrooms will give one kati of the dried product.

The time which should elapse before a bed should be broken up is, to a certain extent, a matter of discretion. The important point is that the whole mass of straw should be permeated by the mycelium so that it can be used as spawn for the establishment of new beds. Three months from the date of sowing is regarded as a suitable age for this. A bed of 16 ft. x 3½ ft. x 4 ft. may be expected to yield about ten bags of spawn which are sufficient for the establishment of ten new beds. If sufficient straw is not available for the construction of new beds, the spawn should be dried in the sun and stored in sacks for the next season. It is stated, however, that the viability of the spawn

*1 kati = 1⅓ lbs.

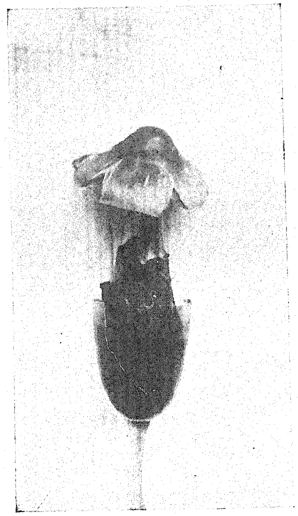
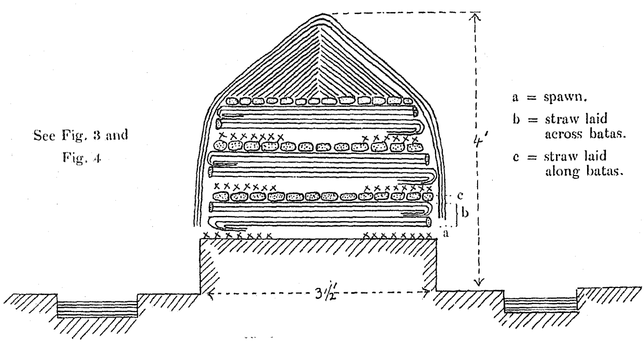


Fig. 1. Volvaria volvaceae—Fully expanded.

See Fig. 3 and Fig. 4



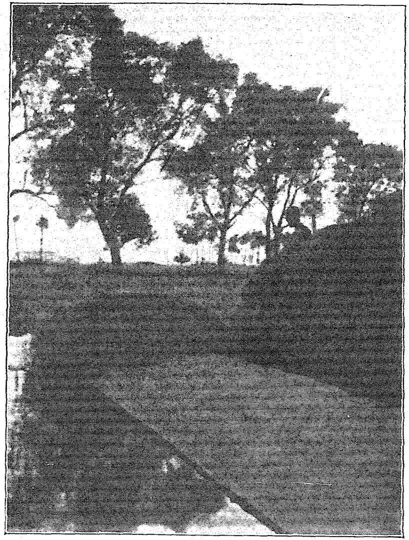


Fig. 3. Mushroom Bed—Earth Bed before straw has been laid.

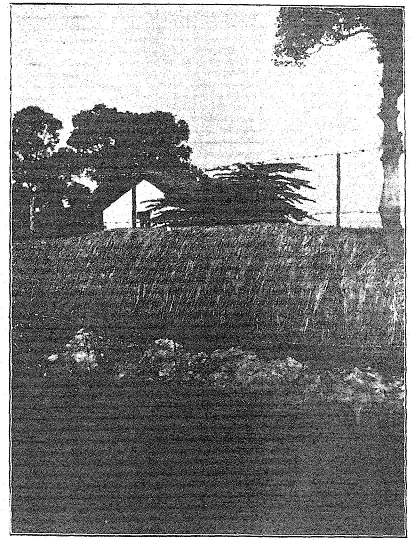


Fig. 4. Finished bed.

diminishes if it kept too long and that it is preferable to establish a series of new beds whenever the old ones are broken up. At the same time, old rotted straw is not regarded as suitable so that, if the mycelium is to be retained active throughout the year, provision must be made for the proper storage of large supplies of straw.

The usual market prices for mushrooms in Penang are as follows:—

Dried	...	\$1.20 — \$1.50 per kati.
Fresh	...	0.30 — 0.35 ,,

As eight to nine kati of fresh mushrooms yield only one kati of dried mushrooms, it is usually more profitable to sell them in the fresh state, and only those which are unsellable are dried.

In districts where padi straw is readily available, mushroom cultivation would seem to have several points in its favour, namely:—

(*a*) no materials are necessary except straw and water,

(*b*) the only capital expenditure required is the initial purchase of spawn,

(*c*) although the beds require constant attention, the work is in no way laborious and would not occupy more than an hour or two every day,

(*d*) in so far as there is apparently a wide market for mushrooms, the occupation would probably be very profitable.

With regard to (*b*) it may be remarked that there is no reason why spawn should not be made available at very much lower prices than at present. At the time of writing, the industry is exclusively in the hands of a few growers in Penang who require \$4 for a bag of spawn. This price could almost certainly be very greatly reduced.

As regards (*d*) it may be noted that the demand in Penang greatly exceeds the supply and that, in order to purchase fresh mushrooms, it is necessary to to visit the market early in the morning. Later in the day the stock is sold out. The consumption, it is true, is chiefly by Chinese, but enquiry shows that Malays are also fond of mushrooms though they ordinarily eat wild species only. Flavour is not likely to present a difficulty and *Volvaria*, in fact, resembles the English mushroom very closely in flavour.

There remains also the possibility of exporting dried mushrooms from padi areas (where alone their cultivation could be profitably undertaken) to areas in which padi is not grown. It is probable, therefore, that mushroom growing would form a profitable accessory industry to padi cultivation, in much the same way as does fish-rearing at present.

Summary.

1. The cultivation of the edible mushroom—*Volvaria volvaceae*—on padi straw is described.

2. Yields of one to two kati of fresh mushrooms per day may be obtained during the season, from a bed 16 ft. long, 3½ ft. wide and 4 ft. high.

When such a bed is broken up, spawn, sufficient for the establishment of 10 new beds, can be obtained.

3. A description of a method of drying fresh mushrooms over a charcoal fire is given. It is found that eight or nine kati of fresh mushrooms will be required to produce one kati of dried mushrooms.

4. The usual market prices for mushrooms in Penang are $1.20 to $1.50 per kati for dried and 30 cents to 35 cents per kati for fresh mushrooms.

At present the demand in Penang exceeds the supply.

5. It is considered that mushroom growing could form a profitable accessory industry to padi cultivation, since the only materials required are padi straw, water and spawn; the work is not laborious and there is a ready market for the produce.

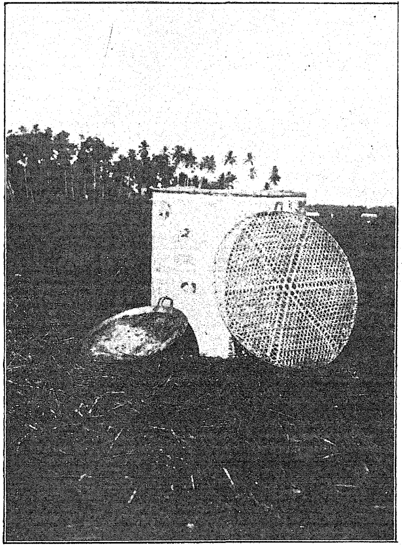


Fig. 5. Apparatus used for drying Mushrooms.

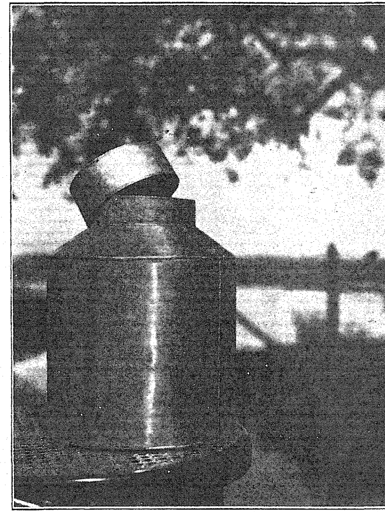


Fig. 6. Air-tight tin suitable for storing Mushrooms.

THE OIL PALM IN SUMATRA

BY

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Introductory.

In the following article it is proposed to record observations made during a visit to the East Coast of Sumatra in May, 1933. A number of estates were visited with the object of ascertaining recent advances in oil palm production in that country. Since the cultivation of this crop is now on an established basis in Malaya, the more important points of interest only are recorded.

Area under Cultivation and Production.

The planted area of oil palms in Sumatra at the end of 1932 is shown as 155,000 acres, of which 97,120 acres were in bearing. The acreage under oil palms in Malaya at the end of 1932 was 61,025 acres.

Exports of oil palm products during the years 1931 and 1932 for Sumatra and Malaya respectively are as shown in the following tables :—

Exports of Oil Palm Products from Sumatra.

Year	PALM OIL.		PALM KERNELS.		Total Value of net exports. F.
	Quantity Tons.	Value F.	Quantity Tons	Value F.	
1931	60,420	12,084,241	11,996	1,092,149	13,176,390
1932	83,633	11,843,769	17,586	1,190,065	13,033,834

Average exchange value during 1931 $100 = F. 139.
1932 $100 = F. 98.

Exports of Oil Palm Products from Malaya.

Year	PALM OIL.		PALM KERNELS.		Total value of net exports $
	Quantity Tons.	Value $	Quantity Tons.	Value $	
1931	4,575	1,011,610	727	112,093	1,123,703
1932	7,892	1,136,841	1,248	162,695	1,299,536

Returns from the East Coast of Sumatra and Acheen for the year 1932 were 98,036,317 kilos palm oil and kernels from a productive area of 39,321 hectares. This represents a return of oil and kernels amounting to 2,493 kilos per hectare. On a basis of 20 per cent. kernels to oil in production, it will be seen that approximately 2,000 kilos oil and 500 kilos kernels were obtained. This represents yields of 1,784 lbs. oil and 446 lbs. kernels per acre from the area in production. These figures agree closely with the estimated figures of crop returns for an estate in full bearing, published in Bulletin No. 39, Department of Agriculture, S.S. and F.M.S. (1927), page 79; *viz.* 16 cwts. (1,792 lbs.) palm oil and 4 cwts. (448 lbs.) kernels per acre.

Seed Germination and Nurseries.

In general estate practice, seeds are sown in sand beds in damp situations. Higher germination is obtained in beds exposed to full sunlight than those in the shade. Germination is less rapid during the rainy season than during dry weather, owing to the sand beds remaining in a damp condition and developing less heat from lack of sunlight. The usual germination obtained is 80 per cent. within five to six months from sowing. Experiments have shown that immersing seeds for two days in a 1 per cent. solution of hydrochloric acid and rinsing for two days in running water, results in a considerably increased rate of germination.

Seedlings are transplanted from the seed beds when they show two leaves. The land selected for this purpose is always, as far as possible, in a sheltered position with moist fertile soil.

It may be mentioned here that very considerable importance is attached in Sumatra to planting new areas with palms raised from seed of known parentage. The General Experiment Station of the A.V.R.O.S., in conjunction with a number of estates, have paid particular attention to this subject. An adequate supply of such planting material is available, and results to-date thoroughly justify the care taken in this connexion.

Planting.

Palms are generally planted in the field when one year old. The usual planting distance is 9 metres by 9 metres (29.5 ft. by 29.5 ft.) triangular and, although slightly closer planting was seen, the wider spacing is generally undertaken. On hilly land, a planting distance of 9 by 6 metres (29.5 ft. by 19.7 ft.) is sometimes employed. On such land, planting on contour is considered advisable for the purpose of facilitating harvesting operations.

Upkeep of Plantation.

The use of cover crops throughout all planted areas is general and, by a system of selective weeding, it is possible to keep weeding costs at a very low figure. In new clearings four rows of lamtoro, *Leucaena glauca,* are sown

between the rows of young palms. The lamtoro is cut back to 2 feet from ground level when 9 to 12 months old and subsequently slashed every six months. A mixture of *Centrosema pubescens* and *Pueraria javanica* seeds are sown between the rows of lamtoro and allowed to climb over the latter. In course of time the two low-growing cover plants smother out the lamtoro, which dies down and forms a layer of surface humus. This combination of erect and creeping leguminous plants in new clearings appears most effective and several large areas so treated were seen.

In low-lying fields, peria (*Momordica charantia*) is frequently used as a cover plant and makes very even growth in such situations. This cover crop is gaining in popularity since it is of rapid growth and when once established prevents growth of all weeds.

In all clearings, a space of 5 feet radius is kept clean-weeded round the base of the palms. As the palms mature, these spaces are connected up and strip weeding is undertaken, with the object of allowing freedom of movement in harvesting.

On the edges of fields, or in other situations where the growth of cover plants is slow, the legumes are encouraged to ramble by the provision of twigs and palm leaves. The excellent growth of the several cover crops seen, is due undoubtedly, to the regular use of fertilizers. Hand-weeding is generally practised with the object of not stirring the soil, since this encourages surface erosion.

Pruning.

Little or no pruning is carried out on young palms until harvesting commences, usually at about four years from planting. The palms are then cleared up to permit easy collection of the fruit bunches. The removal of the lower leaves is considered to assist natural pollination. Pruning is undertaken subsequently once a year when all palm trunks are cleaned of ferns and other saprophytic growth. Between the intervals of annual pruning, only those palm fronds that are dead, or impede the harvesting of bunches, are removed by means of a short-handled axe. A larger portion of petiole is allowed to remain than is usually seen in Malaya.

Artificial Pollination.

Artificial pollination is commonly practised but is not general. So far as could be ascertained, the consensus of opinion favours artificial pollination in conjunction with regular manuring with artificial fertilizers. The collection of pollen is carefully supervised, since the fresh conditions of pollen, when applied to the female inflorescence, is of paramount importance in securing satisfactory results. Palms are patrolled every four days, requiring approximately one pollinating labourer for every 170 acres of palms in bearing. To enable the pollen to obtain access to the maximum number of female flowers, the labourers

engaged on the work of artificial pollination are provided with an iron L-shaped hook to open the fibrous sheath enveloping the flowers.

Manuring.

The use of fertilizers is generally undertaken, often before the palms reach the bearing stage. The most usual form of manuring is by the use of Cheribon rock phosphate applied annually at the rate of 2 kilos (4.4 lbs.) per palm. This is equivalent to an application of 242 lbs. of Rock phosphate per acre per annum. The cost of manures amounts to approximately Guilders 3.50 per acre with an additional 45 Guilder cents for application. The Rock phosphate is often broadcast on the surface of the cover crops and is washed into the soil by rain. It is obvious that this method of applying Rock phosphate, if as satisfactory as stated, is very economical.

A large number of manurial experiments are carried out on oil palm estates in collaboration with the staff of the General Experimental Station of the A.V.R.O.S., Medan. The size of the individual plots is usually 30 or 36 palms in 6 or 8 replications.

The form of manurial experiment commonly employed is as follows:—

Phosphoric acid,	Rock phosphate or Gafsa, 2 kg. (4.4 lbs.) per palm every year or two years.
Phosphoric acid and Potash.	Rock phosphate and sulphate of potash, 1 kg. (2.2 lbs.) of each fertilizer per palm every year or two years.
Complete Fertilizer.	Rock phosphate 2 parts, ammonium sulphate 2 parts and sulphate of potash 1 part, 2 kg. (4.4 lbs.) of the mixture per palm every year or two years.
Control.	No manure.

In general, the use of rock phosphate has given the most economical increases. A number of experiments have shown an immediate increase of crop of 60 per cent. as a result of the application of phosphate in this form. In new areas, small manurial trials with maize, *Zea Mays,* are laid down to serve as an indication of any marked deficiency of phosphoric acid. Both oil palms and maize react to phosphate under average conditions in Sumatra. Maize, however, reacts to all three fertilizers; whilst oil palms show relatively little response to nitrogen and potash.

It is thus possible by a series of small plots to obtain a preliminary idea of whether response may be expected with the particular soil, from an application of phosphatic fertilizer. The difference in behaviour of the maize plots may be judged by appearance, and when the plants have reached optimum growth, by the weight of green matter and grain. A number of such trials were examined indicating, in the majority of instances, a deficiency in the soil of phosphoric acid.

In addition to the use of artificial fertilizers, all trash and fruit residues from the factory are removed by the estate light railways and returned to the field.

Harvesting and Transport.

Since harvesting is a very important field operation, a considerable amount of organisation is given to this matter. On the estates visited, all fields are connected with the factory by a system of light railways. Each labourer is allotted a definite area, usually about 15 hectares (37 acres). The harvesting tasks are changed periodically to apportion the work fairly. The strongest labourers are employed in harvesting and become very adept in removing the bunches from the palms, without, under normal circumstances, the assistance of ladders. The fruit bunches are cut with a short axe and the crop is carried to the railway in two baskets supported by a "kandar" stick. The harvesting operators are paid by results, in addition to a minimum wage. With palms of moderate height, a good labourer will collect an average of 1,000 kilos (2,205 lbs.) fruit bunches per day. In the case of ten year old palms, averaging 14 to 15 metres (46 to 49 feet) in height, the average daily crop harvested by each labourer is 800 kilos (1,760 lbs.) fruit bunches delivered to the estate railway.

Yields.

It is, of course, impossible to make any general statement regarding yields. On those estates visited, crop returns appeared very satisfactory. It was stated that, to maintain high yields, regular manuring was necessary. On one estate the average production of palm oil in 1932, from an area of 1,700 acres of ten year old palms, was 22½ cwts. per acre. Higher yields are obtained from areas planted from seeds of high-yielding palms. In one instance, a yield of 4,055 lbs. of oil per acre was recorded from a field of 88 acres of seven year old palms.

Factories.

As is generally known, the system of oil extraction in vogue in Sumatra is the press system. Two types of installation were seen, namely the Stork and Krupp, of Dutch and German manufacture, respectively. These installations have already been described in this Journal, vide Vol. XIX, page 533, and Vol. XXI, page 272.

With regard to the recovery of oil and kernels, factory records examined range as follows:—

Oil obtained from bunches—15 to 18 per cent.

Kernels obtained from bunches—3 to 3.8 per cent.

Acknowledgments.

The writer is indebted to Dr. A. d'Angremond, Director of the General Experiment Station of the A.V.R.O.S. and his scientific staff for the courtesy and assistance given. Also to the managers of the various estates visited.

Abstracts.

THE STEADY ADVANCE IN TEA PRICES.

Mr. L. G. Stephens, writing in "The Financial Times," states that while most tea shares at present prices are already discounting the immediate position, the prospects of better results in the future give scope for further recovery. His article, which strikes an optimistic note, is as follows:—

On several occasions during recent months when reviewing the tea position it has been pointed out that the selling price of tea had fallen to a greater extent than was actually justified by the statistical position of the commodity But as has been the case with so many products during recent years, a surplus of even a moderate amount, combined with the possibility of further accumulations, has been sufficient to have a marked effect on prices at the sales.

Some reflex of this contention in regard to tea has been seen in the advance which has taken place in selling prices for all teas at the auctions since the announcement of the unanimous adoption of the restriction scheme by the producers in India, Ceylon and the Dutch East Indies.

The following table shows the averages at last week's sales, together with a comparison of the same date in 1932 and in 1931:—

		3rd Aug., 1933.	11th Aug., 1932.	13th Aug., 1931.
Northern India	...	11.11d.	7.71d.	9.46d.
Southern India	...	10.92d.	6.61d.	7.45d.
Ceylon	...	1s. 1.78d.	8.07d.	1s.0.50d.
Java	...	9.18d.	4.71d.	6.39d.

It will be seen that the averages are not only well above those of 1932, but also they are ahead of those for the corresponding sale in 1931.

Common Varieties.

So far the teas which have benefited most are the common variety, the latest average for these being 9¾d. per pound, which compares with the lowest point touched of 4½d. per pound.

Medium teas are now coming into keen demand, and at the past week's sale some of these teas are up by 1½d. per pound.

It should be pointed out that the advance of recent weeks has been in spite of the fact that the sales have mostly comprised the finish of last season's teas from Northern India.

The first of the new season's teas from Northern India will shortly be coming up for sale, and also the better quality teas from Ceylon. The auctions will, therefore, be watched with considerable interest. Further good sales are anticipated, the demand being stimulated by the knowledge that there will be a decrease in supplies as the effect of the restriction scheme comes fully into force.

The competition at the auctions has been very keen, and the trade is apparently of the opinion that higher prices will be reached and maintained.

It may be recalled that the restriction scheme is to date as from April 1 last, and is to be in force for a period of five years, the estimated decline for the first year being approximately 121 million lb.

One of the strong points of the scheme is the prohibition of fresh planting during he period of restriction.

The scheme was the subject of lengthy discussions and has been so designed as to be as effective as possible, and the export of tea is now subject to licence by the various Governments.

Producers' Burdens.

It would, indeed, seem that "the old order changeth, giving place to new." Whatever the economists of the past may claim for the laws of supply and demand, producers have had to invent new rules which act more quickly, rather than just wait for the survival of the fittest with a drain on all concerned.

With the chief buying of commodities now in the hands of a few strong groups, with the lesser concerns following their lead, the lot of the producers has indeed been a parlous one. In the case of tea they have had to carry the burden of harvesting and financing crops without the certainty of even getting back their outlay. Thus, with a product such as tea, where the centres of production are within a certain geographical area, a combination of producers is the only logical outcome, and this is possibly of benefit to the consumers also, because, had large areas been forced out of production, there would have been a great shortage of tea later on with a corresponding rise in the price.

The restriction scheme aims at so regulating supplies as to give to growers an adequate return for the risk involved in producing a semi-tropical commodity, without unduly raising the price to consumers.

Propaganda Work.

The various tea associations are also fully aware of the importance of extending the market for tea. In the past India has been the only country to levy a cess for this purpose, the funds so raised being used to carry on propaganda. The chief centres of activity have been in India itself, where, in spite of the fact that this country produces the bulk of the tea, little is retained for internal consumption. Good work has also been done in the United States. Naturally, these efforts have been retarded owing to the depression, but the work has been continued.

It is now hoped to bring all the various producers into a scheme so as to carry on the propaganda as a whole. With Ceylon and the Dutch East Indies providing funds for this purpose, work on a much larger scale can be undertaken.

The Indian Tea Association has also been selling a fair quantity of tea to Russia, as it is realised that it is important, as far as possible, to keep the taste

for tea alive in that country. The contracts that have been made have been on long-term credit, all of which have been duly carried out. But, owing to the recent breaking off of trade relation with that country, the contracts had to be suspended. It is hoped to get these fixed up again.

One of the features in regard to tea is that the consumption in the United Kingdom has continued to expand in spite of the depression through which the country has been passing.

British Market.

The following figures of consumption per capita in the United Kingdom during the last ten years are significant:—

	lbs.		lbs.
1923	8.60	1928	9.15
1924	8.82	1929	9.25
1925	8.85	1930	9.80
1926	8.91	1931	10.30
1927	9.02	1932*	11.00

*Estimated.

As to individual companies, with the reduction in crops, costs will show some advance, but these will on the whole be well below the level of recent years. The stopping of manuring and other economies will tend to keep down costs. Even with restricted crops the earning capacity of most companies will be good, owing to the low figure at which the estates are capitalised. The fluctuations in earnings as represented by 1d. per pound on the last crops, are set forth in the manual published by the "Financial Times."

Inasmuch as the companies have suffered by falling prices, owing to the percentage which a few pence per pound represents, so in the recovery they will benefit.

The share market has been very active, with an all-round advance in prices, the keen demand for stock having found the market in short supply, and buyers have had to advance prices in order to secure the shares required.

While most shares at present prices are already discounting the immediate position, the prospects of better results in the future give scope for further recovery—*The Planters Chronicle.*

GERMINATING COCONUTS ON A NEW VOLCANIC ISLAND, KRAKATOA.†

After being quiescent for more than forty-three years, the Krakatoa volcano renewed its activity in December 1927. Heavy eruptions started from a submarine crater situated in the centre of the basin, between the three islands of the Krakatoa group, and the ejected volcanic materials formed a cone which in January 1928 appeared above the surface of the sea, and formed an island which was 175 metres long and 3 metres high. In the following months activity

† The following interesting account was published as a letter under the signature of W. Docters Van Leeuwen, Leersum, Bergweg, 188 in *Nature* October 18, 1933.

was most severe and a cone 200 metres high was built up having a volume of about twenty-five million cubic metres! This island was soon destroyed by the waves and eventually disappeared. This was Anak* Krakatoa I.

Activity started again on March 25, 1928, but it was not until January 1929 that a second new island rose above the waves. At the end of February the island was about 40 metres high and 275 metres long. In the early days of July this island, Anak Krakatoa II, also was washed away.

Anak Krakatoa III was born on June 3, 1930, and it was destroyed by the sea on August 8. The submarine cone, however, was now so firmly constructed that three days later the fourth child of Krakatoa appeared, which was a healthy baby, and grew in a short time into a big island, Anak Krakatoa IV.

In the month of January 1932, one of the officials of the volcanological service, who paid a visit to the new island, brought me some seedlings, picked up by him on the beach, and I had myself an opportunity of visiting the island in the month of May of the same year. It was then 40 metres high and comprised an eccentric hot crater lake and some solfataras on its margin. The wall of this lake was on one side 40 metres high and very steep, and sloped on the other side gently to the beach, which was more than 1 km. long.

On this beach, which consisted of black sand, a great quantity of pumice and logs was washed ashore and many plant seeds had already germinated. I found many seedlings of common drift plants and of plants of the *Barringtonia* association. The following seedlings were found: *Pandanus tectorum*, *Canavalia rosea*, *Ipomoea pes-capræ*, *Barringtonia speciosa*, *Terminalia Catappa*, *Xylocarpus granatum*, *Pangomia pinnata*, and 41 germinating coconuts.

This last find was of special interest, as in this case there could be no question at all whether the nuts had been planted or not. No native, with the exception of the coolies of the volcanological service, had dared to land on this still active and treacherous crater, nor was there anything for them to find there. Moreover, the coconuts lay on the beach and were mostly unburied, lying between the pumice and the logs in the same disorderly manner as the seedlings of the other plants, as to which no one questions their distribution by the sea. Some coconuts were just beginning to sprout; others had already formed a bunch of leaves and were rooted firmly in the soil. They were here in exceptionally good condition, as the crabs, which often ruin the germinating nuts, were not present on the beach. We thus find on this new island a strong proof of the ability of the coconut, when washed ashore, to establish itself on the beach without human aid.

After a rest of some months, the crater again started into activity in November and the poorly-developed vegetation was covered over by the ejected volcanic material.

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* Anak is the Malay word for child.

Reviews.

Latex and its Industrial Applications, by Frederick Marchionna.

This book, published in 1933 by the Rubber Age Publishing Co. New York, consists of 1037 pages which includes separate indexes of authors, patentees, patents and subjects. It contains a preface by Professor G. Bruni of the Pirelli Rubber Co. Milan and a preface by the author, together with a brief Historical Introduction.

The first seven chapters of the book, dealing respectively with rubber plants; the planting and cultivation of rubber; collection and extraction of latex; preservation of latex and rubber; behaviour and characteristics of latex; coagulation of latex and preparation of raw rubber; consist mainly of brief introductions followed by useful abstracts of patent and technical literature relating to the problems in each individual chapter.

Chapter VIII, which is the largest section of the book, occupying about 500 pages, contains an introduction on the Direct Use of Latex in Industry, followed by various sections containing, as in the previous chapters, abstracts of patent and technical literature dealing with various specific applications of latex.

Chapters IX, X and XI deal respectively with artificial latex; electro deposition of latex and the structure of rubber. In each of these chapters, a similar treatment is adopted *viz.* an introduction followed by lists of abstracts of patent and technical literature.

The subject matter, as stated by Professor Bruni in his preface, comprises 2490 abstracts of which 1887 are patents and 600 of scientific or technical papers.

The book is of considerable value to all scientific workers who are concerned with latex. Its principal value is as a book of reference, since, as has been indicated above, the principal contents consist of abstracts of patent and technical literature.

The chief criticism which the reviewer has to make is that some of the abstracts of the earlier technical literature might well have been omitted, since they are of no real value at this time, except historically.

In Chapter III on the Collecting and Extracting of Latex, quite a number of patents dealing with tapping tools are abstracted. These might have been omitted, since, as is well known, only about three or four types of tapping knives are now in use on rubber plantations. The majority of the patents for tapping tools, like many other patents, only rest in the dusty archives of various patent offices.

Further, an abstracted description of a tapping tool is not of much value without an illustration.

A few abstracts are misplaced *e.g.* in Chapter IV "The Preservation of Latex and Rubber" p. 114 abstract 346 deals with the treatment of latex to obtain specific properties in the prepared rubber.

Page 119 abstract 372 deals with the character and properties of Castilloa latex and refers chiefly to coagulants of this latex.

Page 123 abstract 383 deals with coagulation phenomena and should be included in Chapter VI.

Athough the author has abstracted articles appearing in the Agricultural Bulletin of the Federated Malay States and the Archief voor Rubber Cultuur of Netherlands India, he does not appear to have abstracted much information contained in the special bulletins or pamphlets on rubber published in these countries. This chiefly affects the question of priority of publication in relation to problems which have been investigated in both countries, since most of the information in these publications has been published separately in other journals and has been abstracted by the author from these journals.

In spite of these criticisms, the author is to be congratulated on the immense amount of time and labour which he must have devoted to this excellent compilation, which is of great value as a book of reference to those engaged in scientific work on behalf of either the rubber producer or manufacturer.

B. J. E.

Coir.

Report on the Attributes and Preparation of Coconut Fibre,
by S. G. Barker, Ph. D., D.I.C., F. Inst. P., M.I, Chem. E., F.R.S.E., F.Z.S., F.T.I.
Empire Marketing Board Bulletin No. 71, September, 1933.

This report is of definite local interest, dealing as it does, with the qualities and uses of a by-product of the copra industry, namely Coir, which is extracted from the husk of the coconut.

It is stated that "at present the whole year's production of coir fibre for spinning is about three and a half million tons. Actually only 100,000 tons are used, the remainder being wasted owing to the fact that no commercial use can be found for it. There is, therefore, an abundance of the raw material and the future of the industry would seem to lie in finding new uses for the fibre and carrying out research work to discover if it can be rendered comparatively cheaply into forms more favourable for utilisation in other directions then those at present ".

Extensive information is supplied in the report on the coconut palm and its habitat, and on the methods adopted by the raiats in the different tropical countries in the preparation of coir.

It is an axiom amongst workers engaged in scientific investigation of industrial processes and practice that there is always a good scientific basis for established industrial practice, and, although the methods of soaking and retting coconut husk in most tropical countries may be somewhat primitive, there are sound scientific reasons for each part of the process. The report discusses

these methods and their significance at some length, before passing on to the question of chemical and mechanical methods for quick retting of the husks.

Under this heading, five different modern processes are described and it is stated that the H. G. process with ionized oil, which is adaptable to either factory or co-operative village conditions, is now being developed and large-scale plant is already designed and installed in London. It is interesting to note that in this process use can be made of coconut oil, ionized and suitably treated.

In connexion with sorting the fibre into the market grades of "mat fibre" used in ropes, twines and matting, "bristle fibre" for brushes and brooms, and "curled fibre" for mattresses, stuffing upholstery and as a substitute for horse hair, mention is made of a method, put forward by a British firm of machine makers, for separating the classes of fibre mechanically and keeping distinct the separate qualities of the fibre.

A section is also devoted to utilisation of residues from fibre extraction and many useful suggestions for further work on this question are made.

The properties of coconut fibre are fully reviewed in a section which reveals the obvious uses of coir. For ropes it is to be recommended where elasticity or resistance to decay is desired, especially in ropes subject to the action of sea water. On the other hand, as a textile fibre it has been considered to be of little general value because of its coarseness, harshness, brittleness and colour, qualities which, however, are desirable in other directions. It is thought that chemically and mechanically retted coconut fibre opens up a new vista in the outlook for the future of coir. A new use of importance, which has already passed the experimental stage, is the use and preparation of protective lagging materials for underground pipes and cables. The superior durability and resistance to decay of coir, as well as its absorbent properties for pitch etc. indicate its utility as a road surface reinforcing medium and it is stated that experiments in this regard are now being organised.

The final chapters are concerned with manufacturing processes, and bleaching, along with remarks on the properties and uses of coconut shell.

The report is of considerable interest and value and should stimulate research into the possibility of increased utilisation of coir.

A. T.

Reports of the Field Branch for the Year 1932.

Department of Agriculture, S.S. and F.M.S. Special Bulletin, General Series No. 15. 209 pp. 5 plates. Price 50 cents.

In accordance with what has now become established practice, the reports of the various officers of the Field Branch of the Department, for the year 1932 are published in Bulletin form.

The re-organisation of the Department has resulted in very much greater importance becoming attached to the work of the officers of this Branch than formerly was the case. The gradual systematisation of extension work, and the opening up in the majority of circles of Agricultural Stations and Test Plots, has greatly increased the activities and the utility of this section of the Department and most field officers have now under their charge a certain amount of experimental work in addition to instructional and inspectional activities.

In this respect, these services may now be regarded as having been brought into line with accepted standard practices in other parts of the world.

Through the courtesy of the administrations of the Unfederated States, it has been possible to include accounts of the work done by seconded agricultural officers in these territories, which, it may be pointed out, is, in most States, conducted along lines which have become standardised in the Straits Settlements and Federated Malay States, and the efforts in progress closely correlated thereto.

The reports give an idea of the many lines of work in progress and also afford a review of the agricultural conditions in each area.

On the present occasion, certain of the reports are illustrated by photographs indicating some of the undertakings operated by the Branch.

H. A. T.

List of Experiments at Present in Progress at the Government Experimental Plantation, Serdang.

Department of Agriculture, S.S. and F.M.S. Special Bulletin, General Series No. 16. 29 pp. Price 50 cents.

This publication is issued as a supplement to the the Guide to the Government Experimental Plantation, Serdang published in 1931.

It gives details of the large amount of experimental work in progress on a considerable number of crops.

The nature and scope of the experimental work in hand has been greatly expanded during the past two years. Its inception definitely marks the second stage in the history of the Plantation, whereby trials with possible crops to ascertain their suitability for cultivation have now become supplemented, and to an extent replaced, by definite experimental work. These experiments are designed to investigate cultural and manurial requirements and the methods of manipulating the produce of crops which have been found suitable for cultivation and which have to a greater or less extent entered into commercial cultivation.

The increasing number of, and area under, agricultural crops other than rubber in the Peninsula is one of the most interesting features of Malayan Agriculture at the present time, and in facilitating their development the Serdang Station can fairly lay claim to have played a useful and not unimportant part.

The present publication will, it is believed, prove to be a very necessary and useful adjunct in the hands of visitors to the Station.

For its compilation, Mr. J. N. Milsum, Senior Assistant Agriculturist in charge of the Station, with the other members of the Station Staff, are responsible.

H. A. T.

Departmental.

FROM THE DISTRICTS.

The Weather.

The cool wet weather continued during the first half of December practically throughout the Peninsula, heavy rainfall causing flooding in Kelantan and small floods in some localities along the lower portion of the Perak River. The second half of the month was warmer and fairly dry. While precipitation was up to the average for the month in many places, it was below average in Krian District, in Central Perak, on Cameron Highlands and on the east coast of Pahang.

Remarks on Crops.

Rubber.—The average price of rubber showed but little variation from that of November. The highest and lowest prices in dollars and cents per picul recorded during the month for rubber from small holdings were :—Smoked Sheet $12 to $17.95; Unsmoked Sheet $10 to $15.60; Scrap $1.50 to $7. The average Singapore prices are not available, but are known to be but little different from those for November. The Penang prices for Unsmoked Sheet ranged from $13.30 to $14.60 as compared with $12 to $14.20 in November.

The situation in respect of tapping showed but little change from that described for November. Wet weather interfered with tapping during the first half of the month, while in large portions of the States of Negri Sembilan and Pahang the padi harvest was a further factor contributing towards a reduced output of rubber from small holdings. On the other hand, in Johore, every effort was made to obtain the maximum production in order to meet anticipated expenses at the Mohammedan and Chinese New Year holidays.

In Kelantan, efforts made towards the improvement of native rubber are having a small though increasing effect. Another two small--holders have begun to use hand rollers for preparing sheet and there is increased interest in the use of acetic acid instead of alum as a coagulant.

Mouldy Rot disease continued to be in evidence during the wet weather, but there was some further increase in the use of approved disinfectants in certain areas.

Padi.—The price of padi at the Government Rice Mill, Bagan Serai, at $1.62 per picul, was the same as in November, and there was little change in the general range of prices throughout the country, these being 5 to 13 cents per gantang, except in Kedah, where prices fell considerably, more especially for the new crop now being reaped.

In the important padi-growing areas of Kedah, Province Wellesley, Krian and Malacca, crop prospects remain good. Harvest commenced in Kedah and the Province and was in full progress in several parts of Malacca.

In Pahang, the harvest was nearing completion in the greater portion of the riverine area, where the crop has, therefore, escaped damage from floods. The crop reaped is reported as being good on the whole. Harvest had also commenced in other parts of the State, with the exception of portions of Kuala Lipis District.

In certain localities in the inland districts of Selangor, the planting dates for the longer period varieties of padi were, contrary to departmental advice, so arranged that the harvest fell during the wettest period of the year and in the fasting month. The same is true of the planting dates in the Jelebu and Seremban Districts of Negri Sembilan. In all these areas, loss of crop has occurred owing to the wet conditions which often caused lodging. In Rembau District a good crop was being reaped.

In Kelantan, considerable damage was caused to the standing crop by floods. In Upper Perak, Kuala Kangsar and Larut Districts of Perak, planting has been late and prolonged; rats are more prevalent than usual and crop prospects are, in consequence, uncertain.

In Johore, Padi Planting Rules have been introduced by means of which dates can be fixed for the season's operations as in the Federated Malay States. These Rules should ensure better synchronisation of the season's work and, in consequence, more even ripening of the crop, thus reducing the loss caused by pests.

Coconuts and Copra.—There was again a slight decline in the price of copra which ranged from $2.55 to $2.60 in Penang and elsewhere from $1.50 to $3 per picul.

Interest among Malays in the preparation of improved copra is, on the whole, well maintained. New kilns were completed, or in course of erection, at Sungei Batu in Penang Island, Sungei Tontong in the Dindings and Kubang Ulu in Province Wellesley. In Krian, a good sample of copra has been made on the recently completed brick kiln at Tanah Kebun and work has been commenced on a second kiln on Jalan Bahru. In Pahang, the owners of the original mud-walled kiln at Temerloh have almost completed a second brick kiln and a kiln at Kertau has been completed, while a small mud-walled kiln is being built at Kuala Pahang.

In Selangor, owing to the fasting month, there has been an increased demand for nuts in the inland Districts which has been supplied from the coastal Districts.

Fruit.—It is reported that a crop of durians was being obtained around Manong in Kuala Kangsar District, but that rambutans were not yet ripe. In Selangor, there were good crops of durians, mangosteens and rambutans and smaller crops of minor fruits. Tree fruits were also ripe in the States of Negri Sembilan and Pahang. Durian fetched from 7 to 15 cents each in Central Perak and Negri Sembilan and 5 to 10 cents each in Western Pahang. Mangosteens sold for 45 to 50 cents a hundred in Negri Sembilan but only 25 to 30 cents

a hundred in Pahang; while in the former State, the price of rambutans was 50 to 80 cents a hundred.

A recent census of the area planted with fruit, other than pineapples and bananas, in Pahang shows a total area of 4,000 acres, including the fruit trees planted in holdings of mixed crops.

Coffee.—A heavy second crop of coffee was being harvested in Kuala Langat District of Selangor, where the price for beans was 19 to 20 cents per kati. The number of Malays manufacturing coffee in this District is increasing, while those who have been longer in the business were working overtime to cope with the supplies of cherry. In the Temerloh District of Pahang, coffee seed and seedlings have been supplied to Malays and Chinese for planting up new land. Should the present interest in this crop continue there will be a considerable increase in the area planted with coffee in this District during 1934. In one locality in Johore, small holdings have been planted with Liberian coffee which is showing good growth. Further planting in this locality is expected.

Seedlings of "Blue Mountain" coffee, grown from seed imported from Jamaica during the first half of 1933, were being transplanted into the field on one or two properties on Cameron Highlands. A further supply of seed has been ordered by this Department.

Arecanut.—These palms were yielding crops in most localities, but the price was very low, though varying considerably in different parts of the country. In Johore, sundried split nuts sold for 80 cents to $3 per picul, in Selangor for $2 to $5 per picul and dried nuts from other centres at $1.50 to $3 per picul.

It is reported that, in a number of instances, arecanuts have been dried on copra kilns during wet weather in Batu Pahat District of Johore.

Tobacco.—Prices for sundried tobacco leaves have ranged for the most part from $10 to $30 per picul according to quality, but the top price in Malacca was $35 and in Johore $45 per picul, while in Penang Settlement it was only $20 per picul.

There are no reports of any important changes in the planted area. A recent estimate places the total area planted with this crop in Pahang at 147 acres, yielding an average of 3 piculs of leaf per acre. Of this total, 111 acres are in Raub District.

Agricultural Stations.

At the Selama Agricultural Station, in the standard experiment on the manuring of annual crops, a much better growth was shown by gingelly planted on the plots which received 15 tons per acre of a leguminous cover crop, turned in 5 and 1 week respectively before planting, than on the plots receiving 15 tons of non-leguminous material turned in at the same intervals before planting. No marked differences were noticeable between the various sub-plots treated with inorganic fertilisers in this experiment.

Two cockerels and six pullets of each of the three breeds Rhode Island Red, White Leghorn and Light Sussex were received from England at the Tanah Rata Experiment Station, Cameron Highlands on the 18th December and were installed in the six runs recently prepared.

A severe outbreak of fowl typhoid in the neighbourhood resulted in the death of three Light Sussex pullets and one cockerel and one Rhode Island Red pullet at the Sungei Udang Station in Malacca.

At the Padi Experiment Station, Telok Chengai, Kedah, four strains of the long grained, Indian, 4-months, Kalyaman variety yielded over 500 gantangs per acre. An excellent crop of all other varieties was expected.

The State Agricultural Officer, Perak, and the Agricultural Officer, Krian, visited this Station, Gajah Mati Agricultural Station and Langgar Padi Test Plot on December 23rd.

Padi Test Plots.

The highest yields so far recorded from the Kajang Padi Test Plot in Selangor were obtained during the season just concluded; the three best strains being Padi Kelantan with 446, Nachin 27 with 438 and Radin Siak with 382 gantangs per acre. The high yields are attributed to the effect of ploughing.

Yields from the Kuang Padi Test Plot were, however, poor, owing to damage by the padi fly, *Leptocorisa* sp., and by birds while the grain was ripening. Of the 6½ months strains, Nachin 10 was the best with a yield of 242 gantangs per acre; while of the shorter term varieties, Radin Siak gave 210 gantangs per acre.

A party of 75 leading local padi growers, including the local headmen, visited the Briah Test Plot in Krian on December 4th. Another party of 200 local headmen and cultivators, accompanied by the District Officer, visited the Selinsing Test Plot in the same district on December 7th.

A demonstration for local headmen was held at the Pasir Puteh Experiment Station in Kelantan on December 5th and another at the Central Experiment Station, Kota Bahru, on December 20th.

School Gardens.

The final judging of the School Gardens in Penang Settlement was carried out during the month. This showed that the general standard of the gardens is improving.

Judging for the annual competition in the Negri Sembilan was also completed. The winning schools exhibited a very satisfactory standard of work, Senaling, the cup winner, being an excellent example of what can be achieved under school conditions.

In Malacca Settlement, there was a noticeable increase in the number of gardens reaching a very high standard and the selection of the winning garden was much more difficult than it has been in past years, owing to the uniformly

good results achieved by the first six or eight gardens. The best garden in Malacca was that of Melekek School.

Home Gardens Competitions.

Judging in the State of Negri Sembilan took place in Seremban and in Rembau and Tampin Districts. In the former, results were disappointing, but in the latter the competition produced some outstanding attempts to achieve the ideal *kampong* from the point of view of food production. Some attempts were, however, too ambitious and many of the gardens were of an uneconomic size. Those making a genuine attempt at gardening were selling surplus produce and appeared to be convinced of the economic value of the venture.

In Pahang East, there were 221 home gardens of which sixty obtained above average marks. The special prize in Pekan District was won by a boy of 16 years old and that in Kuantan District by a headman of Beserah.

Sawah Competition.

In the Seremban District of the Negri Sembilan, of 37 competing padi holdings, 12 were inspected for final awards. On the whole, the standard of maintenance was high and indicated in a striking manner what can actually be achieved by diligent and good management.

DEPARTMENTAL NOTES.

Tours.

The Chief Field Officer toured in Penang Settlement and the four northern Districts of Perak from December 8th to 13th inclusive. He inspected the Agricultural Stations at Bukit Mertajam, Selama and Kuala Kangsar; Titi Serong Padi Experiment Station; the Padi Station at Bukit Merah in Province Wellesley and Talang in Kuala Kangsar District and all Padi Test Plots in the area visited.

Appointment.

Mr. A. Thompson, Assistant Mycologist, Department of Agriculture, S.S. and F.M.S. has been appointed Mycologist, Department of Agriculture, S.S. and F.M.S. with effect from the 12th October, 1933, inclusive.

Leave.

Mr. D. H. Grist, Agricultural Economist and Editor, returned from leave on December 4th 1933.

Mr. F. C. Cooke, Copra Research Officer, returned from leave on December 8th, 1933.

MALAYAN AGRICULTURAL EXPORTS, NOVEMBER, 1933.

PRODUCT.	NET EXPORT IN TONS.				
	Year 1932	Jan.-Nov. 1932	Jan.-Nov. 1933	Nov. 1932	Nov. 1933
Arecanuts ...	20,280	18,549	20,086	2,428	2,353
Coconuts, fresh† ...	108,123	200,588	94,102	9,981	7,701
Coconut oil ...	11,932	10,647	16,149	1,437	1,436
Copra ...	97,464	90,690	96,966	12,543	10,201
Gambier, all kinds ...	2,925	2,771	2,294	225	267
Palm kernels ...	1,248	1,098	1,813	125	100
Palm oil ...	7,892	7,300	10,466	1,010	1,219
Pineapples, canned ...	66,291	60,510	54,340	3,807	3,069
Rubber § ...	417,137	376,163	414,631	34,031	41,843
Sago,— flour ...	10,267	9,293	6,034	1,815	2,247
„ — pearl ...	3,128	2,953	2,277	237	360
„ — raw ...	4,148*	3,833*	3,917*	503*	435*
Tapioca,— flake ...	9,028	8,346	9,185	500	494
„ — flour ...	392	88	370*	220	188*
„ — pearl ...	19,977	18,567	16,247	2,003	1,679
Tuba root ...	165½	114½	498	9	62

† hundred in number. § production. * net imports.

Statistical.

MARKET PRICES.

December 1933.

Rubber.—The market price of rubber has been steady during the month, opening at 13 14/16 cents per lb. for Spot loose in Singapore and closing at 14 cents per lb. The average price for the month was 13 9/16 cents per lb. in Singapore, 4 3/16 pence in London and 8 11/16 cents Gold in New York as compared with $13\frac{1}{8}$ cents, 4 3/32 and $8\frac{1}{2}$ cents Gold respectively in November.

Palm Oil.—The course of the market Liverpool/Continent during December on a basis of 5 per cent. f.f.a., c.i.f. was as follows:—December 2nd £15.5.0 per ton net, December 9th £15.0.0 per ton net, December 18th £15.0.0 per ton net, and December 27th £15.0.0 per ton net.

Prices in the U.S.A. landed weight per pound in bulk c.i.f. New York/Philadelphia were 2.80 cents Gold on the 2nd December, 2.75 cents Gold on the 9th December, 2.75 cents Gold on the 18th December and 2.75 cents Gold on the 27th December.

The price of palm kernels Fair Average Malayan Quality c.i.f. landed weight on the Continent was Shillings 7/6 per cwt. on December 2nd; Shillings 7/6 per cwt. on the 9th December; Shillings 7/6 per cwt. on December 18th and Shillings 7/6 per cwt. on the 27th December.

Copra.—There was a slight fall in price during December. The highest Singapore price for Sundried during the month was $3.15 per picul, and the lowest price $3.00 per picul, the average price per picul being $3.08 as compared with $3.21 during November.

The mixed quality averaged $2.40 per picul as compared with $2.52 per picul in November.

Coffee.—The price at Singapore for Sourabaya Coffee as in the previous month continued steady, prices ranged according to grade, from $16 to $18 per picul. Palembang coffee averaged $12.25 per picul during the month, being quoted at $12 on the 1st and $12.25 on the 29th; the average figure for November was $12.31.

Arecanuts.—Palembangs averaged $1.96 per picul and Bila Whole $2 per picul as compared with $1.98 and $2 per picul during November. The range of Singapore prices for other grades was Split $2.50 to $4 per picul; Red Whole $3 to $4.50 per picul; Sliced $5 to $7.50 per picul and Kelantan $3 to $3.50 per picul.

Rice.—The average wholesale price of Siam No. 2 ordinary rice per picul in Singapore in November was $3.31 as compared with $3.48 in October. No 1 Rangoon rice averaged $3.10 per picul in Singapore in November, the average price for October being $2.88 per picul.

The average retail market prices in cents per gantang of No. 2 Siam rice in November were:—Singapore 24, Penang 27, and Malacca 27, as compared with 24, 20 and 27 respectively in October.

Tea.—During November the average price quoted in London for Malayan Tea was Shillings 1/0.99. Average prices during November for tea consignments from other countries were as follows: Ceylon, Shillings 1/3.76; Java Pence 11.59; Indian Northern, Shillings 1/1.19 and Indian Southern, Shillings 1/1.29.

Gambier.—The price of Block Gambier remained steady during December at $4 per picul, Cube No. 1 averaged $6.50. Corresponding figures for November were $4 and $7.25 respectively.

Pineapples.—Values increased slightly during December, the average Singapore price per case being as follows:—Cubes $3.14, Sliced Flat $3.04, and Sliced Tall $3.10, as compared with $3.02, $2.94 and $3.07 respectively during November.

Tapioca.—The price of Flake Fair averaged $4.45 per picul as compared with $4.06 in November. Pearl Seed averaged $5.42 per picul a slight increase on the November price of $5.17, and Pearl Medium averaged $5.70 per picul, the average price being $5.50 in the previous month.

Sago.—Pearl-Small Fair increased in price during December, averaging $3.90 per picul during the month; the price was $3.65 in November. Flour-Sarawak Fair averaged $1.79 per picul this being a slight fall in value as compared with November average of $1.80½.

Mace.—Prices fluctuated somewhat during December, the average for the month for Siouw being $64.00 per picul, and $42.00 per picul for Amboina.

Nutmegs.—There was a slight increase in the price of 110's during the month as compared with November prices the average being $19.60 per picul, 80's fell slightly in value, averaging $24.40 per picul.

Pepper.—Average Singapore prices during December were as follows:—Singapore Black $13.30 per picul; Singapore White $22.60 and Muntok White $23.60; the corresponding figures for November were $13.00, $22.25 and $22.87 per picul respectively.

Cloves.—There was a slight fall in the price of Zanzibar during the month as compared with November price, the average price was $38.00 per picul during December. Amboina remained steady as in the previous months at $45.00 per picul. These are nominal prices.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co., Ltd., Kuala Lumpur, and the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY.*

For November, 1933.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during November 1933, amounted to 51,261 tons, as compared with 52,474 tons in November 1932, of which 49 per cent. were consigned to Singapore, 25 per cent. to Penang, 7 per cent. to Malacca, 16 per cent. to the Federated Malay States and 3 per cent. to the Unfederated Malay States.

Of these imports, 55 per cent. were from Siam, 40 per cent. from Burma, 4 per cent. from Indo-China and 1 per cent. from other countries.

Total foreign exports of rice from Malaya in November 1933, were 13,875 tons (including 171 tons local production) as compared with 17,553 tons in November 1932.

Of these exports 72 per cent. were consigned to Netherlands India and 28 per cent. to other countries.

Net imports for the period January to November 1933, were 395,367 tons as compared with 370,105 tons during the same period for 1932, an increase of 6.7 per cent.

India and Burma.—Total foreign exports of rice during October 1933, were 91,000 tons as compared with 99,000 tons in the previous month and 72,000 tons in October 1932, a decrease of 8 per cent. in respect of the previous month and an increase of 26 per cent. in respect of the same period in the previous year.

Total exports during the period January to October 1933, were 1,655,000 tons as compared with 1,866,000 tons for the corresponding period of 1932, a decrease of 11 per cent.

Siam.—Exports (approximate) during November 1933, amounted to 113,685 tons as compared with 135,908 tons in November 1932, an increase of 20 per cent.

Netherlands India, Java and Madura.—At the end of October 1933, the area harvested amounted to 8,820,000 acres, an increase of 131,000 acres or 1 per cent. as compared with the corresponding date of 1932: the area damaged was 441,000 acres an increase of 86,000 acres or 24 per cent. as compared with 1932, and additional plantings awaiting harvesting amounted to 1,255,000 acres an increase of 235,000 acres or 23 per cent. The total acreage at the end of October 1933, amounted to 10,516,000 acres, an increase of 452,000 acres or 4 per cent. as compared with the same period in 1932.

Imports of rice into Java and Madura during January to September 1933, totalled 104,344 tons, a decrease of 9,456 tons or 8 per cent. as compared with the same period of 1932.

Imports of rice into the Outer Provinces during January to September 1932, amounted to 192,702 tons.

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*Abridged from the Rice Summary for November 1933, compiled by the Department of Statistics, S.S. and F.M.S.

French Indo-China.—Entries of padi at the port of Cholon from January to November 1933, amounted to 1,034,000 (metric) tons, a decrease of 14,000 tons or 1 per cent. as compared with the same period of 1932.

Exports of rice from Saigon for the period January to November 1933, totalled 1,162,000 tons, an increase of 72,000 tons or 7 per cent. as compared with the corresponding period of 1932.

Ceylon.—Imports for the period January to October 1933, totalled 358,626 tons, a decrease of 13,193 tons on the imports for the same period of 1932.

Of these imports 19 per cent. were from British India, 81 per cent. from other countries.

Europe and America.—Quantities of rice shipped from the East were:—

(*a*) To Europe for the period January 1st to November 16th, 1,180,759 tons, an increase of 252,370 tons or 27 per cent. as compared with the same period of 1932. Of these shipments 47 per cent. were from Burma, 2 per cent. from Japan, 43 per cent. from Saigon, 7 per cent. from Siam and 1 per cent. from Bengal, as compared with 53 per cent. from Burma, 3 per cent. from Japan, 36 per cent. from Saigon, 5 per cent. from Siam and 3 per cent. from Bengal in 1932.

(*b*) To the Levant, period January 1st to October 21st 1933, 22,989 tons, a fall of 24,156 tons or 51 per cent. as compared with the same period of 1932.

(*c*) To America and the West Indies for the period January 1st to October 13th 1933, 141,352 tons, an increase of 28,567 tons or 25 per cent. as compared with the same period of 1932.

MALAYA RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING NOVEMBER, 1933.

State or Territory (1)	Acreage of Tappable Rubber end 1932 (2)	Estates which have entirely ceased tapping: Acreage (3)	Percentage of (3) to (2) (4)	Estates which have partly ceased tapping: Acreage (5)	Percentage of (5) to (2) (6)	Total (3) + (5) (7)	Percentage of (7) to (2) (8)
STRAITS SETTLEMENTS :—							
Province Wellesley	44,734	1,397	3.1	7,479	16.7	8,876	19.8
Dindings	6,969	209	3.0	762	10.9	971	13.9
Malacca	111,780	4,822	4.3	16,978	15.2	21,800	19.5
Penang Island	1,635	626	38.4	205	12.5	831	50.8
Singapore Island	28,269	9,730	34.4	5,139	18.2	14,869	52.6
Total S.S. ...	193,387	16,784	8.7	30,563	15.8	47,347	24.5
FEDERATED MALAY STATES :—							
Perak	250,951	5,200	2.1	35,428	14.1	40,628	16.2
Selangor	308,379	7,595	2.5	41,092	13.3	48,687	15.8
Negri Sembilan	228,541	7,342	3.2	20,824	9.1	28,166	12.3
Pahang	38,141	6,139	16.1	5,596	14.6	11,735	30.7
Total F.M.S. ...	826,012	26,276	3.2	102,940	12.4	129,216	15.6
UNFEDERATED MALAY STATES :—							
Johore	325,747	23,597	7.2	34,413	10.6	58,010	17.8
Kedah (a)	114,551	3,784	3.3	7,370	6.4	11,154	9.7
Kelantan	21,175	7,840	37.0	2,303	10.9	10,143	47.9
Trengganu (b)	4,352	Nil	Nil	2,072	47.6	2,072	47.6
Perlis (a)	957	177	18.5	468	48.9	645	67.4
Total U.M.S. ...	466,782	35,398	7.6	46,626	10.0	82,024	17.6
TOTAL MALAYA ...	1,486,181	78,458	5.3	180,129	12.1	258,587	17.4

Notes :— (*a*) Registered companies only and are rendered quarterly.

(*b*) Registered companies only.

The above table together with a Summary, was prepared and published by the Statistics Department, S.S. and F.M.S. in December, 1933.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF NOVEMBER 1933 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month		
								during the month		January to Oct. 1933		during the month		January to Nov. 1933				
	Ports	Dealers	Estates of 100 acres and over	during the month	January to Nov. 1933	during the month	January to Nov. 1933	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	13,616	12,017	12,174	124,437	10,092	99,818	Nil	Nil	Nil	Nil	16,542	6,404	161,825	65,291	...	12,983	11,958
Johore ...	...	3,000	3,056	3,926	39,913	4,944	48,317	Nil	2	Nil	121	1,530	6,958	15,470	72,443	...	3,196	3,244
Kedah ...	...	437	2,121	2,733	26,388	1,652	15,212	Nil	Nil	Nil	Nil	1,351	2,852	13,832	28,296	...	506	2,234
Perlis ...	...	16	10	8	92	33	168	Nil	Nil	Nil	Nil	Nil	32	Nil	270	...	21	14
Kelantan ...	...	426	207	200	2,029	452	5,823	126	Nil	1,049	Nil	101	813	908	7,777	...	309	188
Trengganu ...	...	55	50	180	1,548	90	773	Nil	Nil	Nil	Nil	Nil	270	Nil	2,321	..	55	50
Total Malay States	...	17,550	17,461	19,221	194,407	17,263	170,111	126	2	1,049	121	19,524	17,329	192,035	176,398	...	17,070	17,688
STRAITS SETTLEMENTS :-																		
Malacca ...	...	3,197	1,289	1,490	14,777	3,036	26,778	1	17,414	15	177,063	3,829	Nil	44,955	Nil	...	2,943	1,285
Province Wellesley	...	1,049	689	551	5,737			Nil		Nil						...	1,307	588
Dindings ...	...	43	177	109	1,101			Nil		Nil		7,217		72,064		...	53	202
Penang ...	1,750	5,527	11	10	59			1,542		9,423						3,995	5,764	9
Singapore ...	4,741	30,410	125	164	1,661			13,179		103,457		24,029		206,779		2,542	31,662	123
Total Straits Settlements	6,491	40,256	2,291	2,324	23,335	3,036	26,778	14,722	17,414	112,895	177,063	35,075	Nil	323,798	Nil	6,537	41,729	2,207
TOTAL MALAYA	6,491	57,806	19,752	21,545	217,742	20,299	196,889	14,848	17,416	113,944	177,184	54,599	17,329	515,833	175,398	6,537	58,799	19,895

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
20	21	22	23	24	25	26
DRY RUBBER	9,499	26,778	4,830	4,130	1,285	177
WET RUBBER	3,484	4,884	934	173	1,911	329
TOTAL ...	12,983	31,662	5,764	4,303	3,196	506

TABLE III
FOREIGN EXPORTS

PORTS	For month	January to Oct. inc. 1933
Singapore ...	33,458	318,141
Penang ...	12,202	116,770
Port Swettenham.	7,968	69,901
Malacca ...	971	11,021
MALAYA ...	54,599	515,833

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	during the year 1933
Malay States ... / Straits Settlements	40,486	405,419
MALAYA ...	40,486	405,419

Notes:—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i. e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + 12 tons local consumption during the month —[2]—[3]—[4]—[5]—[9]—[10]. For the Straits Settlements, Columns [9] and [10] represent purchases by dealers from local estates of less than 100 acres. reduced by 15 % to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15; wet sheet, 25; scrap, lump, etc., 40; stocks else where are in dry weights as reported by the dealers themselves.

4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5 The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 22nd December 1933.

METEOROLOGICAL SUMMARY, MALAYA, NOVEMBER, 1933.

Locality	Air Temperature in Degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total	Total	Most in a day: Amt.	Number of days: Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total	Daily Mean	Per cent
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.								
Railway Hill, Kuala Lumpur, Selangor ...	89.4	72.0	80.7	92	70	84	74	83.2	84.3	6.44	163.6	1.24	21	16	7	9		129.30	4.31	36
Bukit Jeram, Selangor ...	87.0	72.1	79.5	90	70	83	75	82.9	85.2	8.41	213.6	1.54	21	19	3			136.75	4.56	38
Sitiawan, Perak ...	87.8	72.6	80.2	93	70	79	75	83.3	84.9	7.99	203.0	1.52	16	11	4			146.70	4.89	41
Temerloh, Pahang ...	86.0	72.5	79.2	90	71	78	74	82.8	85.2	5.85	148.6	0.77	24	22		1	1	125.55	4.19	35
Kuala Lipis, Pahang ...	85.4	71.4	78.4	90	70	75	73	82.0	83.9	14.42	366.3	2.71	27	24	2	24		112.80	3.76	31
Kuala Pahang, Pahang ...	83.5	73.5	78.5	88	71	77	76	81.7	83.7	21.54	547.1	4.32	24	22	1			140.70	4.69	39
Mount Faber, Singapore ...	85.2	72.4	78.8	89	70	79	74	80.1	81.6	9.12	231.7	3.89	23	17	5			99.15	3.31	27
Butterworth, Province Wellesley ...	85.0	73.2	79.1	89	70	77	76	82.2	84.2	9.72	246.9	1.78	19	16	1		1	145.15	4.84	41
Bukit China, Malacca ...	84.3	73.3	78.8	90	71	80	75	81.6	83.2	4.13	104.9	0.79	19	12				130.40	4.35	36
Kluang, Johore ...	85.8	71.5	78.7	90	70	79	73	80.5	81.6	15.42	391.7	4.36	23	16	1	6		105.10	3.50	29
Bukit Lalang, Mersing, Johore	83.3	71.9	77.6	89	70	76	73	80.0	81.0	24.58	624.3	5.39	29	25	1	1	1	112.35	3.75	31
Alor Star, Kedah ...	85.7	72.7	79.2	90	70	76	75	83.1	84.8	7.75	196.9	2.68	17	14	6	1		138.55	4.62	39
Kota Bahru, Kelantan ...	82.8	72.7	77.7	91	71	74	75	80.8	83.4	39.57	1005.1	7.24	24	22				120.55	4.02	34
Kuala Trengganu, Trengganu	83.2	72.3	77.7	89	70	76	74	80.1	82.0	26.50	673.1	3.46	24	20			1	118.90	3.96	33
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. Pahang ...	71.2	61.8	66.5	78	59	63	64	70.9	71.5	13.45	341.6	1.76	26	24	1	23		85.50	2.85	24
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	70.7	57.6	64.1	73	52	64	61	69.3	69.6	12.12	307.9	2.15	25	23		1	3	86.30	2.88	24
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	70.5	58.9	64.7	74	57	62	61			12.14	308.4	2.18	25	23		2	3	91.30	3.04	25

Compiled from Returns supplied by the Meteorological Branch, Malaya

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THE

Malayan Agricultural Journal.

FEBRUARY, 1934.

EDITORIAL.

Agriculture in Netherlands India.

In the present number of this journal, prominence is given to an abstract of a recent publication—"The Export Crops of Netherlands India in 1932". Abstracting this bulletin at such length is justified for several reasons. In the first place, Malaya cannot afford to ignore the importance of a country which can claim to satisfy, to the following extent, the world's demand for a number of important products such as rubber 29 per cent., sugar 11 per cent., tea 18 per cent., cinchona 93 per cent., copra 29 per cent., sisal 29 per cent., kapok 79 per cent., and pepper 75 per cent.

Secondly, the publication is an excellent review of the agricultural enterprise—both as large scale production and on small holdings—in the country to which it refers. With the increasing diversification of agriculture in Malaya, reliable knowledge of what is being successfully accomplished in Netherlands India cannot but prove of great value. We also venture to predict that the many readers of the *Malayan Agricultural Journal* in countries outside Malaya will find this abstract of interest and value.

It is regretted that it has been impossible to print the abstract as submitted for publication, owing to limitations of space in the journal. The reader will, however, with the aid of the abstract, be able to consult the original bulletin—which is in the Dutch language—with ease and to abstract for himself more detailed figures than are here given, and to refer to many other crops of perhaps less importance in Malayan agriculture, than are treated in the abstract.

No attempt is here made to convert figures of metric weights and areas into English equivalents. At the end of the abstract, however, will be found a conversion table, by the use of which the reader will be able to convert such figures for any crop as he may desire.

Attention must again be drawn to the original publication, which is a mine of information. It demonstrates the diversity and value of agricultural enterprise in Netherlands India, which places the welfare of the people of that country in an impregnable position, minimising the effect of low market prices by alternative sources of livelihood and rendering them more self-reliant in the matter of satisfying domestic needs from local resources.

Fruit Propagation.

The accusing finger is often levelled at the poor quality of fruit grown in Malaya. It is pointed out that supplies are uncertain and that the quality of many varieties is irregular and very frequently, inferior to the produce of other countries.

Scientific improvement is necessarily slow, owing to the length of time which must elapse by reason of the fact that most fruit trees take many years to reach maturity. Practical improvement is retarded because of the conditions under which fruit is usually grown in Malaya. The bulk of supplies originate from small holdings where, more frequently than not, trees of widely dissimilar nature are mixed and where effective selection of stock is generally entirely neglected.

The solution of these problems leads us along many avenues of research. Not only have we to carry out scientific work on the improvement of stock, but to ensure that by improved planting methods and education, the native may take full advantage of any superior varieties of fruit trees that are evolved.

While the organisation for the latter desideratum is not being overlooked, attention is being given to a study of existing fruits and steps are being taken towards their improvement by selection and other methods. An article on "The Propagation of Fruit Trees by the Etiolation Method", which is included in this number, describes the adaptation of the etiolation method to local conditions and its use and value in perpetuating desirable qualities in a number of local fruits.

The possibility of employing vegetative propagation over a wider range of fruit trees is receiving attention and will result in more planting material becoming available of trees which can be guaranteed to reproduce faithfully the good qualities of the parent stock.

Storage of Oil Cakes.

One of the early results of the recent imposition of duties on various edible oils imported into Malaya, and of a smaller duty on the import of the raw material from which such oils are expressed, has been considerably increased activity in the local production of such oils. In particular, this applies to coconut and groundnut oils.

One of the main difficulties regarding local oil production has been the disposal of the residual cake—used for cattle food—in good condition. An article on the "Storage of Oil Cakes" in the present number records the results of an investigation on this subject.

The writer shews that while there are only small changes in the oil content in storage, there is an increase in acidity of the oil, except in the case of the by-product from the milling of parboiled rice.

A marked increase of acidity will affect both the palatability and digestibility of the oil cake. It is suggested, therefore, that it is preferable to rely upon purchases in small quantities at frequent intervals and where possible to purchase direct from the oil mill, in order that the material may be as fresh as possible.

As regards rice milling by-products, it is shewn that the parboiled products are superior to the white rice products, even though the colour of the latter, particularly the polishings, may be more attractive.

Original Articles.

THE PROPAGATION OF FRUIT TREES

BY

J. LAMBOURNE,

Assistant Agriculturist.

Introductory.

The propagation of fruit trees by what has been described as the "etiolation method" is new to Malaya, but has been in use for some years at the East Malling Research Station, Kent, England. The method was evolved some years ago for the purpose of propagating deciduous fruit trees. The reason for adopting the method was due to the fact that it had long been apparent that stocks on which fruit trees were grafted could not be relied upon to behave uniformly, the consequence being variation in vigour and fruitfulness of resulting trees. Stocks for certain purposes were raised from seed, while for other purposes vegetatively produced stocks were used. There was always considerable variation in the performance of seedling stocks and those produced by vegetative means were not found to be much better in this respect. Consequently, some method by which clones of stocks which would give a uniform performance could be propagated vegetatively was necessary.

It was early apparent that certain desirable fruit tree stocks were not easily rooted by ordinary methods and the etiolation method, which is a modification of layering, was brought into use and has proved successful for the purpose of raising apple, plum and cherry stocks.

A visit was paid to East Malling by Mr. J. N. Milsum while he was on leave in 1931-32, and on his return to Malaya, experiments were commenced with a view to propagating tropical plants such as tea, coffee, and fruit trees, by this method. The success so far attained in the propagation of tea has been published recently, and in the present article it is proposed to give the results so far attained with the propagation of fruit trees by this method.

Methods of Propagation.

Fruit trees have been propagated by vegetative means from very early times and these methods include grafting, budding, cuttings, layering and marcottage. The methods of grafting and budding have for their object the building up of a tree from two different plants, *i.e.* the stock or rooting portion and the scion or portion grafted or budded upon the stock. The influence which the stock has upon the scion makes it desirable that the former should show as little variation as possible so that, with experience, the performance of any particular tree grown upon it can be judged, within narrow limits. This can

only be attained by raising stocks by vegetative means. Considerable investigation is necessary, however, before these methods can be adopted for tropical fruit trees.

The propagation of certain fruit trees by means of cuttings and marcottage with the object of producing trees growing upon their own roots is well known in Malaya. Before the method of propagation about to be described can be carried out, it is necessary to use these methods, more especially marcottage, for the production of plants for laying down in etiolation beds.

It is a well known fact that the seedlings of most fruit trees vary considerably, both in the quality and quantity of fruits produced; therefore, if trees having the desirable characters of the parent are to be raised, vegetative methods of reproduction are desirable. Indeed, for certain fruits such as the seedless orange, or the pomelo, it is the only possible method of reproduction. Another advantage to be derived from the vegetative propagation of fruit trees is early maturity. Fruit trees produced by marcottage bear fruits earlier than seedlings of the same species.

The method of propagation used at East Malling has been recently described by Milsum and Marsh and is as follows:—

"The plants required to be propagated are planted in rows each plant being placed obliquely in the soil at an angle of 35° to the horizontal. When sufficiently established, the young trees are laid and pegged down in shallow trenches a few inches below the ground level. As shoots appear from the stem and lateral branches, an inch or so of soil is placed over the entire tree, the growing shoots have thus to ascend through a layer of soil. As growth proceeds, further soil is added until a layer of earth 4—6 inches in depth covers the base of the shoots. The portion of the stem below the soil receives no light and becomes etiolated. This condition is favourable to rooting which occurs freely in the blanched portion of the stem of the shoot below the soil."

It was early apparent that certain modifications of the above procedure would be necessary locally owing to the fact that the plants to be dealt with are evergreen and nearly always in a state of active growth. The temperate fruit trees on which this method of propagation is carried out at East Malling are deciduous and are pegged down in winter when the trees are dormant. The return to active growth in the spring results in the production of vigorous shoots which easily push through the soil. It was found that when certain tropical fruit trees were treated in this way, the branches died back; it was therefore necessary to modify the above procedure.

The Methods adopted at the Central Experiment Station, Serdang.

As stated above, it is necessary in the first place to procure marcots of the fruit trees which it is desired to propagate. To accomplish this a suitable branch with firm, well-ripened wood, is selected. A ring of bark 1—1½ inches wide is removed from just below a node and to this is applied a compost of

leaf mould, soil, sand, and cattle droppings mixed together and moistened so that it can be pressed into a ball. This is secured to the branch with a wrapping of coconut fibre tied tightly with wire, twine or other tying material that will last for a few months under moist conditions. The ball of soil is kept moist until the marcot has produced sufficient roots, when it may be removed from the tree. The time taken for roots to appear varies with different species of fruit trees but with the majority, from two to four months is necessary before the marcot is sufficiently well rooted. It is advisable not to cut the marcots from the tree too soon after roots first appear through the fibre, for, with some trees, such as the rambutan, marcots are difficult to establish unless they are well rooted.

Having removed the marcot from the tree, it should either be planted directly into the etiolation beds or temporarily established in pots. The latter procedure is the more satisfactory for such trees as the rambutan and chiku, owing to the fact that a large number of casualties are liable to occur unless the marcots are given careful attention until they are thoroughly well rooted.

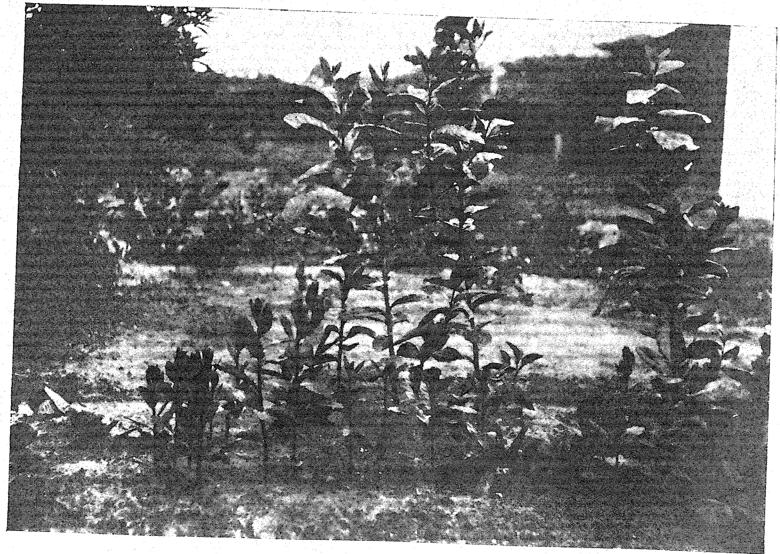
Preparation of the Beds.

When preparing beds for the propagation of trees by the etiolation method the soil should be deeply cultivated and well supplied with organic matter. At the Central Experiment Station, Serdang, trenches 2½ feet wide and 2 feet deep are dug and in filling the trenches, farmyard manure is incorporated with the soil forming a good rooting medium and supplying the plants with nutrients.

The young trees are then planted in a single row in oblique positions about 35 degrees to the horizontal and well watered. When the plants become well established, they may be pegged down in shallow trenches an inch or so below the level of the bed. Young shoots, after varying intervals according to the variety of plant, will appear on the stems and lateral branches. When the shoots are from 4—6 inches in length they are covered at their bases with 2 to 3 inches of sandy soil. As growth proceeds, a little more soil may be added until the bases of the shoots are covered to a depth of 4—5 inches.

When the bases of the shoots have etiolated or blanched, they are then in a condition to produce roots and with some fruit trees such as the lime (*Citrus medica* var. *acida*) and citron this occurs naturally. Other fruit trees such as the chiku (*Achras Sapota*), pulasan (*Nephelium mutabile*) and the orange (*Citrus Aurantium*) are more difficult and it has been found necessary to twist wire round the base of each shoot near the point where it arises from the main stem or branch. This is done to induce callus formation which stimulates root development.

When the shoots are sufficiently well rooted, they are cut from the parent stem and taken carefully from the bed, avoiding, as far as possible, damage to the roots. The rooted plants are potted into bamboo joints or earthenware



CITRON, *Citrus medica L.* A pegged-down plant showing etiolated shoots.

pots and kept under dense shade and in moist conditions until they are well rooted, when they are gradually hardened by reducing the shade. They are then ready to plant into their permanent positions in the field.

Results of Experiments.

Up to the present, experiments with this method of propagation in Malaya have only been carried on for a short time and with comparatively few species of fruit trees. The first beds were laid down at the Central Experiment Station, Serdang, in July 1932, when marcots of the chiku, a large lemon-shaped lime, and a large type of orange were prepared. These plants were pegged down and covered with soil too early, with the result that, instead of shoots appearing through the soil, the branches died back. When this was noticed the plants were uncovered. This treatment enabled both the lime and the oranges to survive, but the majority of the chiku plants died.

Later, in December 1932, additional beds were laid down with marcots of the pulasan, lime and citron, following in February 1933, by rambutan (*Nephelium lappaceum*), jambu betek (*Eugenia* sp.) and the avocado pear (*Persia gratissima*).

The early mistake of completely covering the plants was avoided. The plants were allowed time to become thoroughly established in the beds before they were pegged down and the bases were not covered until shoots had attained a length of several inches.

The lime and citron produced roots freely so that rooted plants were taken from the beds four months after planting and within a month of covering the shoot bases.

The pulasan and avocado pear produced roots fairly easily when the shoot bases were ring-wired. The chiku, however, was more difficult, but rooted shoots were obtained from the surviving plants in the first beds laid down although this did not occur until nearly a year had elapsed after planting. The same applies to the large orange. That these two fruit trees can be made to produce roots in this way is encouraging and given proper treatment it is hoped that rooted plants will be obtained in a shorter time.

The rambutan and jambu betek beds were laid down with marcots taken directly from the parent trees. This method of planting was successful for the latter, but the former were more difficult to establish and only a few survived. A few rooted shoots have been taken from the jambu betek but not, so far, from the rambutans, owing to the length of time these plants have taken to become established.

Other fruit trees which have been laid down in nurseries include the Mandarin orange (*Citrus nobilis*) and the Villa-grande lemon, but as these have been planted only a short time no results have been obtained as yet.

Conclusions.

The etiolation method of propagation has proved successful for a number of fruit trees and also for tea, and it appears possible that this method can be adopted for a number of woody plants that are difficult to propagate by other means.

The advantage of this method of propagation is that once an etiolation bed has been established, a constant supply of young plants can be obtained. To attain this end, however, care should be taken not to remove every shoot that produces roots but to leave a sufficient number for laying down in the future, so that the bed may always be well furnished with rooted plants.

The preliminary work of collecting suitable material for the laying down of beds takes time. It is unsatisfactory to put down plants which, if rooted successfully, will give planting material of unknown or inferior quality. Care should, therefore, be taken to select for this purpose only parent trees which are known to produce good quality fruits.

It is too early to state how trees propagated by this method will thrive when planted out, but there appears to be no reason why they should not behave in a similar manner to trees propagated by marcottage or cuttings.

Summary.

1. The etiolation method of propagation and the reasons for its adoption has been discussed.

2. The methods used at East Malling is given, and also some modifications which have been found expedient when applying it to tropical fruit trees in Malaya.

3. The methods adopted at the Central Experiment Station, Serdang, are given and the results, so far obtained, are discussed.

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2. J. N. Milsum and T. D. Marsh, "The Propagation of Tea from Etiolated Shoots", *Malayan Agricultural Journal*, July 1933, p. 310.

STORAGE OF OIL CAKES

BY

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Introductory.

In view of the importance of oil cakes and meals as ingredients of rations for feeding animals, an investigation has been carried out to ascertain the period during which such materials can be stored, using the oil content and the acidity of the extracted oil as an indicator of the storage qualities.

It is realised that the present investigation can only be regarded as preliminary as far as the general question of the storage qualities of such materials is concerned, since the experiments were confined to oil cakes and meals from local sources.

Collection and Storage of Samples.

The materials used for the investigation included the following :—

(*a*) Rice Milling By-Products
- (i) White Cargo Bran
- (ii) White Polishings
- (iii) Parboiled Cargo Bran
- (iv) Parboiled Polishings

(*b*) Coconut Cake

(*c*) Gingelly Cake

(*d*) Groundnut Cake.

Although rice milling by-products are not usually classified as oil cakes or meals, these by-products were included in the investigation, since they are often compounded with oil cakes or meals in stock rations.

As regards coconut cake, experiments were carried out with two samples of different oil content in order to ascertain whether the storage qualities of this cake as regards change of oil content and acidity of extracted oil could be correlated with the original content of the material.

The experiments with gingelly cake were also duplicated, the first sample being obtained from a wooden mill worked by bullocks, known locally as a *cheku,* while the second was taken from an iron press of a similar design to a *cheku,* but mechanically driven.

In all cases, comparatively large quantities of materials were stored; for example, sacks of rice milling by-products, in order to ensure that the amounts would be comparable with those that would be normally stored when using the materials for feeding purposes.

As regards the conditions of storage, the materials were stored in a dry shed, to which there was free access of air. Dry weather prevailed during the greater part of the period of storage.

Results of Analysis.

The results of analysis of the samples of fresh materials are shown in Table I. In addition to the figures for moisture, oil, and acidity of extracted oil, determinations of ash, crude protein and crude fibre were also made in order to collect additional data in respect of variations in composition of locally produced feeding stuffs.

The following observations are offered on the results:

(*a*) *Rice Milling By-Products.* The higher oil content of the parboiled polishings compared with the white polishings is interesting. As far as can be ascertained, this higher content is due partly to a concentration of the oil in the outer layers of the rice grain during the process of parboiling and partly to the smaller amount of polishing which this type of rice undergoes during preparation. The net result is a smaller weight of polishings of higher oil content.

In the case of the by-products from white rice, the high acidity of the oil is due to the presence in the grain of a fat-splitting enzyme (non-organised ferment) which is brought into contact with the oil during milling. This enzyme would be destroyed during the process of parboiling, thereby resulting in the oil in these by-products being much lower in acidity.

(*b*) *Coconut Cake.* The oil contents of the two samples differ by approximately 6 per cent.

In this connection, it may be pointed out that some local oil mills prefer to maintain a relatively high oil content figure, for example 15 per cent., for coconut cake. It is stated that such a cake, which feels slightly oily, finds a more ready local sale than one in which the oil content has been reduced to 10 per cent., and which is comparatively dry.

(*c*) *Gingelly Cake.* The oil contents of both samples are slightly higher than those recorded generally in literature. This is due to the lower efficiency of the *cheku* type of press compared with the modern cage-press.

(*d*) *Groundnut Cake.* The figure for the sample of groundnut cake calls for no comment.

An interesting feature of the analysis is the high protein content of the cake, which renders it useful as an ingredient for a mixed concentrate, in which it may be necessary to increase the protein content without unduly affecting the amounts of the other feeding constituents.

Results of Storage Experiments.

After a period of eight weeks, representative samples were drawn for analysis, a similar procedure being adopted after the expiry of a further period of four weeks, making a total storage period of twelve weeks.

The results of analysis, which were confined to determinations of moisture, oil and acidity of extracted oil, are shown in Table II. In order to make the results comparable, the figures for the oil contents have all been calculated on a moisture-free basis.

Except in the case of the samples of gingelly cake, the figures for the oil content indicate that, under normal conditions of storage, the decreases in this respect are small. In some cases, for example, the by-products from parboiled padi, the figures show practically no change.

Apart from the samples of by-products from parboiled padi, considerable increases in acidity of the extracted oils must be recorded in all cases. It is interesting to note, however, that the acidities show little tendency to increase during the second period of storage.

As regards the various materials the following comments are offered:—

(a) *Rice Milling By-Products.* The effect of parboiling on the resultant acidity of the extracted oil is clearly indicated both in the low acidity of the original oil and in the small rate of increase on storage.

(b) *Coconut Cake.* Although as regards oil content the storage qualities of this cake do not appear to be correlated with the original oil content of the material, the results of the acidity determinations indicate a greater increase for the cake with the higher oil content.

(a) *Gingelly Cake.* As regards gingelly cake, it is thought that the decrease in oil content and the marked increase in acidity can be ascribed to secondary changes resulting from the addition of sugar to the seed before pressing,* some of the sugar being retained in the cake.

The writer was informed that the objects of adding sugar were to improve the flavour of the oil, also to cause the mass to bind when pressing. From the point of view of the cake there is no doubt that the presence of sugar, which may amount to between 1 and 2 per cent., affects profoundly its storage qualities. Moulds will develop and these, in addition to increasing the acidity of the oil, may actually cause decomposition of the oil or fatty acids. Further, the rate of increase in the acidity of the oil may also be influenced by the presence in the material of various organic acids, for example, acetic acid, lactic acid and succinic acid, produced during the decomposition of the sugar.

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* Milsum, J. N. and Lambourne, J., Gingelly. *Malayan Agricultural Journal,* Vol. XXI, No. 9, September 1933, page 429.

(*d*) *Groundnut Cake.* The results of analysis indicate that, while there is a tendency for the oil content to decrease slightly on storage, the increase in acidity is not so marked as in the case of some of the other oil cakes, being comparable with that found for the sample of coconut cake with the lower oil content.

General.

Although not coming within the scope of this investigation, attention should be drawn to the fact that, after storage for 12 weeks, all the samples were infested with insects, notably *Tribolium castaneum* Hbst. This insect seems particularly attracted to the rice milling by-products.

In addition to *Tribolium,* the following insects were found associated with the coconut cake, *Sylvanus advena* Walk., *Sylvanus surinamensis* L. and *Necrobia rufipes* de Geer.

The gingelly cake and the groundnut cake were the least affected by insect attack, the only insect additional to *Tribolium* being *Ephestia cautella* Wlk.

A possible explanation for the absence of insect attack in the last two cases may lie in the hardness of the cakes. Both the gingelly cake and the groundnut cake were hard in comparison with the coconut cake, which was distinctly friable and which, therefore, it would be easy for insects to penetrate.

Remarks and Conclusions.

The results of analysis indicate that, while there are only relatively small changes in the oil contents on storage, marked increases in the acidities of the extracted oils occur, except in the case of the by-products from the milling of parboiled padi.

There is no doubt that with such marked increases in acidity, both the palatability and possibly the digestibility of the materials would be affected, with the result that, for oil cakes, it would appear preferable to rely upon purchases in small quantities at frequent intervals—for example every month—rather than to attempt to store for longer periods. Further, if possible, purchases should be arranged direct with an oil mill in order that the materials may be as fresh as possible.

As regards rice milling by-products, the figures clearly show the superiority of the parboiled products over the white rice products, even though the colour of the latter, particularly the polishings, may be more attractive.

In conclusion, the writer wishes to thank the Ho Hong Oil Mills Ltd., Singapore, for supplying the samples of coconut cake and groundnut cake.

The writer is also indebted to the Entomological Division for identification of the insects and to Inche Baba bin Ludek, who was responsible for all the analytical work connected with the investigation.

Table I.

Results of Analysis of Oil Cakes and Meals.

Constituent	Rice Milling By-Products				Coconut Cake		Gingelly Cake		Groundnut Cake
	White Cargo Bran	White Polishings	Parboiled Cargo Bran	Parboiled Polishings	Sample No. 1	Sample No. 2	Sample No. 1	Sample No. 2	
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Moisture ...	9.5	9.9	8.4	7.6	11.3	11.8	14.8	18.8	7.8
Oil ...	4.1	15.1	7.0	24.7	16.3	10.3	13.7	15.1	10.9
Crude Protein ...	7.4	12.3	8.9	15.9	17.3	17.6	30.5	28.7	47.9
Crude Fibre ...	19.3	4.5	19.1	7.0	9.0	7.3	5.9	6.6	3.6
Ash ...	12.2	5.9	12.4	7.5	4.8	5.2	10.4	9.2	4.8
Nitrogen-free Extract (by difference) ...	47.5	52.3	44.2	37.3	41.3	47.8	24.7	21.6	25.0
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Oil (calculated on moisture-free basis) ...	4.5	16.8	7.6	26.7	18.4	11.7	16.0	18.6	11.8
Acidity of Oil* (calculated as oleic acid) ...	19.8	10.8	3.6	1.7	9.1	7.8	8.9	4.9	8.9

* In the case of coconut cake the acidity of the oil is calculated as lauric acid.

Table II.

Variation in Oil Content and Acidity of Oil on Storage.

Nature of Material	Period of Storage	Oil (calculated on moisture-free basis) per cent.	Acidity of Oil (calculated as oelic acid) per cent.	Remarks
White Cargo Bran ...	Fresh 8 weeks 12 weeks	4.5 4.2 3.2	19.8 43.9 40.9	
White Polishings ...	Fresh 8 weeks 12 weeks	16.8 16.9 15.6	10.8 52.6 55.3	
Parboiled Cargo Bran ...	Fresh 8 weeks 12 weeks	7.6 7.9 7.8	3.6 6.9 9.9	
Parboiled Polishings ...	Fresh 8 weeks 12 weeks	26.7 27.2 26.4	1.7 3.1 4.4	
Coconut Cake (Sample 1) ...	Fresh 8 weeks 12 weeks	18.4 17.2 18.0	9.1 41.6 46.1	Acidities of oil calculated as lauric acid.
Coconut Cake (Sample 2) ...	Fresh 8 weeks 12 weeks	11.7 11.0 10.8	7.8 24.5 27.8	Acidities of oil calculated as lauric acid.
Gingelly Cake (Sample 1) ...	Fresh 8 weeks 12 weeks	16.0 15.3 13.2	8.9 61.2 61.4	
Gingelly Cake (Sample 2) ...	Fresh 8 weeks 12 weeks	18.6 14.7 14.0	4.9 51.5 55.0	
Groundnut Cake ...	Fresh 8 weeks 12 weeks	11.8 12.1 10.0	8.9 22.8 25.4	

Abstract.

THE EXPORT-CROPS OF NETHERLANDS INDIA IN 1932.

Bulletin No. 115 of the Central Bureau of Statistics of Netherlands India.

This annual bulletin is mainly limited to a review of agricultural activity, the object of which is production for the world market. Consequently, a sharp distinction is made between produce from estates, owned and managed by foreign capitalists, and native-grown produce. Whereas the bulk of the former is grown for the purpose of export, most of the native produce—rubber excepted—is grown for local consumption. Consequently the report deals with native agriculture only in respect of excess of production, available for export after requirements for local consumption have been satisfied. This excess, in most cases, is small in relation to the requirements of a Netherlands Indies population of about 64,000,000.

Climatic conditions during the year were rather abnormal. During the first half of the year rainfall was excessive, especially in the northern half and the eastern part of Java, whereas the second half of the year was abnormally dry.

Though the volume of exports of agricultural produce remained fairly constant during the years 1928-1932, the value, owing to the world depression, declined steadily as the following figures show.

Year	1928	1929	1930	1931	1932
Gs.	1,237,000,000	1,083,000,000	832,000,000	507,000,000	385,000,000

How heavily Netherlands India has been hit by the depression is shown by the following figures for the values of all exports—mining produce and other goods included—during these 5 years. The figures do not include Government exports, such as Banka tin.

Year	1928	1929	1930	1931	1932
Gs.	1,576,000,000	1,443,000,000	1,130,000,000	747,000,000	541,000,000

Comparison of the two sets of figures also shows the preponderance of agricultural produce in the total value of Netherlands Indies exports, other than Government exports.

The very steady decline of average market prices for the usual standard grades of the principal export crops during these five years is shewn in the following table.

Average Export Prices.

	Rubber per ½ kg.	Copra per 100 kg.	Sugar per 100 kg.	Coffee Robusta per 100 kg.	Tea per ½ kg.
	cents	Gs.	Gs.	Gs.	cents
1928 average	58½	24.03	14.61	88.93	63
1929 ,,	54	21.09	13.66	89.57	57
1930 ,,	30½	18.02	9.60	52.90	46
1931 ,,	15	11.22	8.06	36.30	30
1932 ,,	8½	8.24	6.28	39.03	17½
1932 December	8½	7.61	5.91	40.07	15½

The report gives a set of 3 diagrams, showing the values of estate produce and of native produce, exported from Java, Outer Provinces and the entire Netherlands Indies respectively. These show that the export of native produce from Java is only a small fraction of the export of estate produce from these sources. Considering that the population of Java is now over 43,000,000 and that native agriculture works primarily for local consumption, this is not surprising. Only slightly over 50 per cent. of the exports from the Outer Provinces is native produce. Of the total agricultural exports of the whole of Netherlands Indies about two-thirds is estate produce. For the five years 1928/1932 the figures have been—in percentages of totals—as below:

Produce		1928	1929	1930	1931	1932
Estate	...	65.3	63.5	68.8	67.5	64.2
Native	...	34.7	36.5	31.2	32.5	35.8

Another table gives the percentages of the contribution of estate and of native produce to the values of total exports from the whole of Netherlands India. The following taken therefrom is of local interest:

Percentage of value of total exports from Estates and Native holdings respectively, 1932.

	Sugar	Cocoa	Tea	Gambier	Rubber	Coffee	Tobacco (coarse)	Kapok	Copra and oil	Pepper
Estate ...	99	76	78	62	61	38	24	8	4	1
Native ...	1	24	22	38	39	62	76	92	96	99

Corresponding figures for the four previous years do not vary materially from those of 1932.

Though the production of some crops is enormous the quantity available for export, after satisfying local demands, is very small. Figures of local interest are shown below :

	World Exports	Netherlands India Exports		
	in metric tons 1931	in metric tons 1931	in percentages of world exports	
			1931	1930
Rubber, dry ...	818,537	254,519	31	29
Sugar ...	28,477,000	2,838,737	10	11
Coffee ...	1,675,000	67,990	4	4
Tea ...	409,000	78,742	19	18
Cinchona ...	11,616	10,625	91	93
Copra Oil ...	1,449,319	367,917	25	27
Palm oil, Kernels ...	774,291	73,587	10	7
Sisal etc. ...	239,540	70,278	29	29
Cocoa ...	560,706	1,406	0.2	0.2
Kapok ...	25,697	20,602	80	79
Pepper ...	45,907	31,756	69	75

The principal crops of estate produce are: rubber, sugar-cane, coffee, tea, cinchona and oil palms. Taking the 1921 figures as a basis, the planted areas and crops have increased in volume, to the percentages given below :

	Rubber	Sugar	Coffee	Tea	Cinchona	Oil Palms	
						Oil	Kernels
Area ...	157.9	105.8	95.3	148.4	107.5	541.6	
Production ...	243.5	154.6	140.6	239.6	95.3	4,191	12,035

Excepting cinchona, the yield per unit of planted area has, in every case, increased considerably during the last 12 years. Of these crops, sugar-cane alone requires annual planting.

Of the principal crops, grown by native producers, export figures only are given, except for tea, for which the figures for the total value of purchases of native-grown leaf by the estates are given. Taking the 1921 figures as a basis, the volume—not value—has meanwhile increased to the following percentages :

Tobacco*	Kapok†	Pepper†	Copra†	Coffee§	Tea‡	Rubber*
184.2	102	120.5	131.6	239.2	382.6	1024

During these 12 years, the volume of these native crops has varied greatly. The total value of agricultural exports in 1932 amounted to Gs. 384,882,000.

The estate areas planted and in bearing for the years 1928 to 1932 are given at respectively 1,139,319; 1,165,525; 1,223,329; 1,248,013 and 1,208,546 hectares (1 hectare = 2.47 acre). For the chief crops the 1932 areas (in hectares) and the production therefrom (not including produce purchased from native growers and exported mixed with the estate produce) are as follows:

	Area in hectares		Production
	planted	in bearing	
Rubber ...	582,196	396,747	150,898 metric tons
Sugar-cane ...	166,138	166,138	2,560,182 „ „
Tea ...	135,704	120,734	68,601 „ „
Coffee ...	127,145	109,382	62,714 „ „
Oil palms ...	70,075	43,833	90,073 „ „ Oil 18,414 „ „ Kernels
Coconut palms ...	49,707	30,767	12,284,084 nuts
Tobacco for wrappers	44,487	44,487	33,815 metric tons

These figures do not include areas with mixed crops and the "smallholders" estates of only a few hectares each.

Cane Sugar.

An area of 6189 hectares was planted with pedigree-cane for planting material.

The estate area planted and harvested was 166,138 hectares, the native area 11,000 hectares.

The total crop of estate-grown cane was 22,369,440 metric tons. A total of 23,938 tons of native-grown cane was purchased by and milled in the factories.

The total factory-production of sugar was 2,560,182 metric tons. The crop from the native area is partly consumed in the raw state. About 77 per cent. is converted into native sugar for local consumption and export, chiefly to the

* Native exports.
† Total exports from Netherlands India less estate production.
§ Total of provincial export surplus.
‡ Purchased from native growers by estates.

Outer Provinces. The production of native sugar in 1932 was about 53,000 metric tons, of which 12,014 tons was exported from Java. The native population is increasingly using pedigree planting-material of high-yielding varieties.

Rubber.

The estate area planted is 582,196 hectares, of which 396,747 is in bearing. For the native-owned area, the figures are unknown. For the 5 years 1928-1932 the production has been in metric tons as follows:

Year	Estates	Native (dry)	Total
1928	140,928	91,353	232,281
1929	154,154	108,584	262,738
1930	153,530	90,496	244,026
1931	165,799	88,717	254,516
1932	150,901	61,447	212,348

Of the estate area, planted with rubber, 222,799 hectares are in Java, 341,459 hectares in Sumatra and 17,938 hectares in other islands. Unplanted estate reserve land is respectively 361,967; 561,908 and 65,681, totalling 989,556 hectares. Apart from this, large areas of state land would still be available outside Java.

Some rubber estates have fields with mixed crops, but of the total rubber bearing estate area, 82.9 per cent. only carries Hevea. For Java the figure is 70.2 per cent., for Sumatra 94 per cent., for the other islands 82.7 per cent. The mixed area is proportionately greatest in East Java, the secondary crop usually is coffee. In East Java there is a total of 78,591 hectares, carrying Hevea; of this area 30,736 hectares (= 39 per cent.) is unmixed and 47,855 hectares (= 61 per cent.) is the total of the Hevea-carrying parts of fields of mixed cultivation. Unmixed cultivation is, however, the rule in Sumatra and to a lesser extent also in West Java.

A table on page 84 specifies the estate areas in Java, Sumatra and other islands according to age, from which the following summary for the whole of the N.E.I. is drawn in hectares:

Year of Planting							Total	Tappable
1932	1931	1930	1929	1928	1927	Earlier		
6,912	18,182	31,650	28,520	47,356	43,781	405,795	582,196	396,747

The estate areas abandoned in Netherlands India are given below in hectares—

1927	1928	1929	1930	1931	1932
3,984	5,635	5,312	6,422	9,026	8,814

Estate rubber generally is taken into tapping in its seventh year of growth. To what extent the substitution of old fields by planting of high-yielding material has contributed to production, cannot yet be determined. This substitution has become an increasingly frequent practice during the past few years.

The tappable areas, not tapped in the course of the year, are given in absolute figures and in percentages of the total tappable area. For the whole of Netherlands India the averages were:

1st quarter	2nd quarter	3rd quarter	4th quarter	year
45,076	87,222	117,162	89,607	84,768 hectares
11.4	22	29.5	22.8	21.4 per cent.

Owing to the unevenness of cessation of tapping of part of the area in bearing it is impossible to give reliable figures of yield per area. Comparisons of the calculated figures for the periods January-June 1931 and 1932 showed an increase. This, however, may be due to the fact that the less productive fields were taken out of tapping first; that young fields in which tapping would otherwise have started remained untapped; also to a change of tapping system.

The exports of latex and concentrated latex; 90 per cent. of these exports came from the East Coast of Sumatra, which is particularly well situated for central handling of latex from the large number of adjacent estates. Exports of sprayed rubber were:

	1928	1929	1930	1931	1932
	kg.	kg.	kg.	kg.	kg.
Java	2,875,326	4,001,280	4,248,006	5,090,264	2,371,350
Sumatra	10,770,711	14,850,674	7,928,736	11,307,716	8,246,215

These amounts have been included in the export statistics quoted.

Native rubber is in Java produced in very small quantities. The area, however, is known; it is specified in a table of which the following is a summary.

	1931 planted area	1932 planted area		
		not tappable	tappable	Total
	hectares	hectares	hectares	hectares
West Java ...	5723	2795	2875	5670
Mid Java ...	308	295	55	350
East Java ...	1810	415	1809	2224
Total ...	7841	3505	4739	8244

Owing to the low rubber prices prevailing, these native fields are not tapped and are, as far as possible, being used again for planting food crops.

As a criterion of the extent of native rubber in the Outer Provinces, the export figures have had to serve primarily. A table on page 95 specifies the 1928 to 1932 exports from the various parts of Sumatra and Borneo. The following is a summary of this information in metric tons.

	Group			Total	Dry equivalent	Dry percentage
	1. dry	2. wet	3. wet			
1928	18,492	7,760	102,021	129,753	91,353	70.4
1929	24,111	6,970	114,071	145,527	108,584	74.6
1930	22,425	8,403	89,973	120,801	90,496	74.9
1931	22,940	5,473	89,719	118,132	88,717	75.1
1932	13,142	1,449	67,655	82,246	61,447	74.7

Another table gives the percentages of loss of weight on cleaning and milling of the various kinds of native rubber from Sumatra and Borneo. Native rubber can be classified in 3 main groups

Group 1: has passed through a mill, is clean and dry; loss of weight nil.

Group 2: raw, unpurified scrap and earth-rubber, wet and dirty; loss of weight in milling from 35 to 50 per cent.

Group 3: all other native rubber, moist and unclean; loss of weight in milling from 10 to 33 per cent.

Owing to the big decline of rubber prices, many native growers have stopped tapping and returned to the cultivation of foodcrops. The potential production, however, has further increased and is still increasing.

World Production of Rubber in tons of 2240 lbs.

	Production					Percentage of Grand Total				
	1928	1929	1930	1931	1932	1928	1929	1930	1931	1932
British Malaya ...	297,500	449,600	445,900	434,857	417,137	45.30	51.93	53.92	53.98	57.95
Netherlands Indies ...	228,832	258,733	240,210	250,511	209,019	34.83	29.88	29.04	31.09	29.04
Ceylon ...	56,000	80,500	75,500	61,500	49,500	8.53	9.30	9.13	7.63	6.88
British India ...	10,795	11,720	10,782	8,472	3,896	1.64	1.35	1.30	1.05	0.54
British North Borneo ...	6,799	7,381	7,115	6,247	5,379	1.04	0.85	0.86	0.78	0.75
Sarawak ...	10,750	11,313	10,310	10,451	6,960	1.64	1.31	1.25	1.30	0.97
Siam ...	2,700	2,900	3,900	2,963	2,231	0.41	0.34	0.47	0.37	0.31
French Indo-China ...	9,638	10,934	10,289	11,714	14,436	1.47	1.26	1.24	1.45	2.00
Other growers ...	4,300	5,100	2,100	3,037	2,769	0.56	0.59	0.26	0.38	0.38
Total of plantation rubber ...	627,134	838,181	806,106	789,752	711,327	95.51	96.81	97.47	98.03	98.82
Brazil ...	24,556	22,598	17,137	13,320	6,550	3.74	2.61	2.07	1.65	0.91
Other wild rubber ...	4,950	5,015	3,770	2,575	1,930	0.75	0.58	0.46	0.32	0.27
Total wild rubber ...	29,506	27,613	20,907	15,895	8,480	4.49	3.19	2.53	1.97	1.18
GRAND TOTAL ...	656,820	865,794	827,013	805,647	719,807			100		

The smaller percentage of dry rubber exported in 1932 is due to the fact that a number of small remilling factories have been closed.

The output of the small remilling factories in Sumatra and Borneo in 1928 to 1932 have been—in kilograms:

1928	1929	1930	1931	1932
12,716,865	20,343,060	18,510,749	20,837,794	11,383,675

to which the output of dry rubber, milled by the native growers, has to be added.

A table on page 99 gives the world production for the years 1928-1932, and the percentages contributed to these totals by the various producing countries.

Coffee.

The planted areas, so far as they are known, the estate-production figures and the export figures of native coffee from the Outer Provinces are as follows:—

	Planted Area—in hectares			Production—in metric tons		
	Estates	Native plantations		Estates	Native Coffee export from Outer Provinces	Total
		Java	Outer Provinces			
1928	126,762	unknown	unknown	55,314	70,635	125,949
1929	127,171	10,950	unknown	55,280	58,553	113,833
1930	130,337	15,818	unknown	40,313	54,236	94,549
1931	126,928	17,635	unknown	48,745	54,499	103,244
1932	127,145	20,578	unknown	62,715	69,958	132,673

71 per cent. of all estates are in Java; outside Java, Sumatra is the most important centre for coffee cultivation. Most estates also grow other crops, usually rubber.

The planted area is specified in a table, giving details for the year 1928-1932. For 1932 the percentage figures were:

	Planted with coffee	*With other crops*	*Reserve*
Java ...	26.1	26.5	47.4
Outer Provinces ...	17.3	13.3	69.4
Netherlands Indies ...	23.3	22	54.7

A table specifies the percentages of the production of 1928-1932, contributed by estate produce and by native produce. These averaged 37 per cent. from Java estates, 8.5 per cent. from Outer Provinces estates and 54 per cent. from native holdings in the Outer Provinces.

Nearly all the coffee estates in Java are in the eastern part. Of the total 1932 Java estate production of 51,439 tons, 46,426 tons came from East Java.

The bulk of the native coffee (mostly Robusta) is also in east Java.

Total planted area in 1932			Area in bearing in 1932		
Java	Robusta	Total	Java	Robusta	Total
2,382	18,196	20,578	1,404	11,553	12,957

In the Outer Possessions, the native growers mostly plant Robusta. From the following table, which is an extract of a fully detailed table of the exports of 1928-1932, it will be seen that about 97 per cent. of this native coffee comes from Sumatra (chiefly Palembang, Benkoelen and West Coast). The 1932 export was—in kilograms as follows:—

	Java	Liberia	Robusta	Other kinds	Unshelled	Total
Sumatra ...	1,834,786	—	64,563,746	—	4,037	66,402,569
Other Islands ...	3,015,036	5,076	534,781	—	160	3,555,053
Outer Provinces ...	4,849,822	5,076	65,098,527	—	4,197	69,957,622

The statistical figures of actual exports from Netherlands India to foreign countries do not quite tally with the known and/or calculated production figures owing to the great local consumption, accumulation of stocks and exports from old stocks.* The differences are shown in the following table.

	Known production in metric tons			Export in metric tons
	Estates	Native	Total	
1928	55,314	70,635	125,949	114,531
1929	55,280	58,553	113,833	81,814
1930	40,313	54,236	94,549	61,514
1931	48,745	54,499	103,244	68,581
1932	62,715	69,958	132,673	113,799

* Part of the native coffee, exported from the Outer Provinces to Java, is consumed there and part is stored there. From the table it is obvious that in 1932 a large part of the stocks, accumulated in previous years, must have been shipped.

In Java about 94 per cent. of the planted area is Robusta while in the Outer Provinces 90 per cent. is of this variety.

The Robusta yields per hectare in 1931 and 1932 were :—

		1931	1932
Java	...	560	740 kgs.
Outer Provinces	...	530	540 „
Netherlands India	...	550	690 „

Tea.

A table on page 123 gives summary figures for the planted areas and production in 1928-1932. It shows a gradual decline of native production of tea leaf for sale to estates and to curing factories.

	Planted area hectares		Production of dry tea. metric tons.				
	Estates	Native	Estate, including leaf, purchased from other than native growers		Native leaf, bought by estates and factories		Total
				per cent.		per cent.	
1928	115,237	34,844	57,254	78.6	15,608	21.4	72,862
1929	120,442	37,010	59,825	79.2	15,758	20.8	75,583
1930	126,996	41,202	57,628	80.0	14,363	20.0	71,991
1931	131,440	41,801	66,406	81.7	14,903	18.3	81,309
1932	135,704	39,375	69,513	84.8	12,424	15.2	81,937

Of a total of 325 estates with 135,704 hectares, planted with tea, 285 estates with 102,311 hectares are in Java—247 of which are in West Java—and 40 estates with 33,393 hectares are in Sumatra. There are 9 curing factories, purchasing and treating native-grown leaf; they are all in West Java.

On the tea estates in Netherlands India, 25.7 per cent. of the area is planted with tea, 14 per cent. with other crops and 60.3 per cent. is reserve land.

Of the 135,704 hectares, planted with tea, 120,734 hectares are in bearing, distributed over :

Java : West 84,984; Other parts 9,795.

Sumatra : East Coast 19,894; Other parts 6,061.

Total estate-area in bearing 120,734 hectares.

Information is given respecting the numbers and distribution of the estates, their areas of single or mixed planting, their production from own and from purchased native-grown leaf and on their gradual expansion. An extract is as follows : areas are in hectares.

	1928	1929	1930	1931	1932
Java ...	94,170	95,987	98,589	99,593	102,311
Sumatra ...	21,067	24,455	28,407	31,847	33,393
Netherlands India ...	115,237	120,442	126,996	131,440	135,704

This shows an increase of 8,141 hectares over the 1928 Java area in 5 years, equivalent to 8.9 per cent. and one of 12,326 hectares over the 1928 Sumatra area, equivalent to 58.5 per cent.

A table of world exports in tons is given, from which the following figures are drawn.

	1928	1929	1930	1931	1932
World ...	416,838	438,420	406,716	409,294	423,860
Netherlands India ...	69,658	72,450	72,019	78,742	78,763
Percentage ...	16.7	16.5	17.7	19.2	18.6

Tobacco.

This crop is grown and handled in various ways and the quality of the finished product differs greatly. The estates on the East Coast of Sumatra are in a class by themselves; they produce, nearly exclusively, the most expensive grade, used for cigar wrappers and they handle their own produce only.

In Mid-Java—Soerakarta and Jocjakarta—there is no native cultivation for sale of leaf to estates. All tobacco, grown for export, is grown and cured on estates.

In East Java—Besoeki—the so-called "estates" are, in fact, only curing factories. They hire the land from the native owners who are given the planting material and who grow the crop more or less in the native way under supervision, undertaking to sell the crop to the "estate" against payment on delivery. Locally this is called "estate tobacco", to distinguish it from the tobacco, grown by independent native growers, which is known as "freeman's tobacco" and in the report is classed as "purchased native-grown leaf".

Mid-Java and East Java methods of cultivation and economic arrangements are dissimilar. How much more intensive cultivation is in Mid-Java, is clear from the following figures.

1932		Soerakarta & Jocjakarta	Besoeki	
estate-area	...	6,791	18,904	hectares.
production leaf-tobacco	...	11,068,846	8,333,146	kgs.

In the other tobacco-growing regions, the native growers cure their own crops and sell in the finished state to the middlemen in the trade. The figures

relating to this traffic are incomplete because the large number of Chinese and other small middlemen, who trade in the native produce, remain outside the range of statistical compilation. The native output can only be estimated and has been calculated to be in kilograms, as follows:

	Estate produce from		Total output of estates	Export	Native Tobacco
	controlled areas	native leaf purchased			
	1	2	3	4	4 less 1
1928	9,141,698	11,543,263	20,684,961	37,330,000	28,188,000
1929	9,342,790	7,860,062	17,202,852	48,802,000	39,460,000
1930	8,181,433	10,343,955	18,525,388	42,978,000	34,797,000
1931	9,818,049	12,611,143	22,429,192	45,526,000	35,708,000
1932	6,908,563	3,711,115	10,619,678	41,188,000	34,279,000

To the figures in the last column, local consumption would, of course, have to be added.

Cinchona.

The total area under this crop is 17,780 hectares. Of the 120 estates engaged in the cultivation of Cinchona, only 17 grow it as a sole crop.

The production in 1932 was—in metric tons—8,439 in Java and 1,681 in the Outer Provinces.

Oil Palms.

In 1932 there were 50 estates engaged in the cultivation of oil palms, 39 of which were in North Sumatra, and four in South Sumatra.

Areas and production are specified as follows:

Year	Estates	Planted area in hectares				Production in kgs.		Export in kgs.	
		Java	Outer Provinces	Netherlands India		Kernels	Oil	Kernels	Palm Oil and Kernel Oil
				Total	In bearing				
1928	52	472	49,852	50,324	19,033	5,767,258	27,030,137	5,731,709	28,869,735
1929	48	665	57,046	57,711	23,473	7,065,514	35,970,706	6,836,562	35,876,819
1930	48	707	60,522	61,229	30,017	9,820,548	49,751,695	9,639,066	48,014,596
1931	51	705	67,725	68,430	36,322	12,805,305	64,457,238	12,200,201	61,387,360
1932	50	710	69,365	70,075	43,833	18,413,577	90,072,649	17,884,341	84,973,111

This crop is of very small importance in Java, where it is practically entirely confined to the vicinity of Buitenzorg. In Sumatra, however, especially on the East Coast, it has attracted considerable attention. During the year 1932 only 1,640 hectares were planted.

The area in bearing (hectares) is now distributed as follows:

Java	South Sumatra	North Sumatra	Other Islands	Total
144	2,108	41,526	145	43,833

Of the total area planted, 62 per cent. only is in bearing now and so a considerable increase of output may be expected in the near future. The crop promises to become one of the chief export crops of Netherlands India.

	South Sumatra		North Sumatra	
	Mature area in hectares	Total output in kgs.	Mature area in hectares	Total output in kgs.
1928	1,263	1,927,796	17,556	24,914,899
1929	1,318	2,652,828	21,928	33,139,201
1930	1,718	2,845,121	28,013	46,766,817
1931	2,018	3,344,202	34,018	60,948,533
1932	2,018	4,413,620	41,526	85,490,469

Coconut Palms.

This is predominantly a native crop.

Most of the estates are in the Outer Provinces and most estates do not interplant other crops.

The total estate area in 1932 was, in hectares:

Java	Sumatra	Celebes and Moluccas	Other Islands	Total
6,639	11,222	27,502	4,344	49,707

Of this total area 38,293 hectares, equalling 77 per cent. is unmixed cultivation and 30,767 hectares, equalling 62 per cent. of the total area, was in bearing; from this it may be concluded that estate cultivation is comparatively new.

The estate production of copra in 1932 was 27,312 metric tons, an increase of nearly 4,000 metric tons over that of the previous year.

In addition to this, the estates buy nuts and copra from the native growers. For 1932 this amounted to 2,050 metric tons of copra.

In 1931 the palms recovered from the severe droughts of 1929 and 1930 *Native Cultivation.* In 1931 the palms recovered from the severe droughts of 1929 and 1930 and in 1932 too the too the climate conditions were favourable and a plentiful crop was obtained.

The surplus, available for export from native cultivation, after satisfying domestic consumption, can only be calculated by deducting from the copra export figures the import figures and the estate export figures, all reduced to copra-equivalents. This in Java gives the following figures in metric tons :—

Java	1928	1929	1930	1931	1932
native produce ...	80,113	94,773	8,854	—	77,514

In 1930 the surplus was small; in 1931 imports exceeded exports; 1932 had a considerable surplus again.

Conversion to copra-equivalents has been fixed at 4300 nuts = 1 metric ton copra

1000 litres of oil (220 gallons) = 1.5057 metric ton copra.

The exact extent of native production in Java is unknown. A large part of the copra is consumed locally in the form of oil, milled in local mills; some of this oil is exported to the Outer Possessions and to foreign countries. The report gives two tables; one calculating the quantity of copra milled by these factories, from the known export of oil cake and its estimated local consumption as a cattle-fodder; this would put the quantities of copra, milled in the factories at about—

1928	1929	1930	1931	1932
204,000	207,300	174,600	160,200	174,300

metric tons.

The other table estimates local oil consumption by deducting oil exports from factory production; according to this table, the locally consumed percentage of the oil production of the oil mills in Java was :

1928	1929	1930	1931	1932
69.5	69.5	81.4	92.5	82.3

This would show a decrease of factory oil consumption against a large increase of copra exports. With low copra prices, domestic oil production for domestic consumption increases and the very adaptable small millers in the villages in 1932 increased in numbers. Any estimate of total native production still has to disregard the copra-equivalent of the oil, milled by these village mills, and of the nuts, used for culinary purposes. There also are no reliable data as to what part of the copra, imported into Java from the Outer Provinces, is re-exported and what part is milled for the production of oil.

The quantities of copra, used by the Java oil factories, have been added to the copra exports and from this total the copra imports from the Outer Provinces and the estate exports are deducted. This balance should approximately represent native copra output in Java.

1928	1929	1930	1931	1932
222,600	241,200	153,700	138,200	223,400 metric tons.

This shows a considerable increase of production in 1932.

Outer Provinces. The following figures are abstracted from a table which gives details of the surplus, available for export—to other parts of Netherlands India and to foreign countries—from the various islands and their component parts.

	1928	1929	1930	1931	1932
Total exports ...					428,954
Estate exports ...					22,232
Native exports ...	395,405	396,781	373,866	359,930	406,722

These figures disregard local consumption of nuts.

For the whole of Netherlands India, the estate contribution to copra exports is only 6 per cent. of the total; the situation is dominated by the quantity of native produce in excess of domestic demand.

The total exports of copra alone from Netherlands India have been :—

	Java			Outer Provinces			Total Netherlands India		
	Export	Estate output	per cent.	Export	Estate output	per cent.	Export	Estate output	per cent.
1928	47,534	3,534	7.4	393,317	19,805	5.0	440,851	23,339	5.3
1929	52,858	4,171	7.9	404,011	20,306	5.0	456,869	24,477	5.4
1930	7,358	3,466	47.1	368,359	21,939	6.0	375,717	25,405	6.8
1931	3,846	3,018	78.5	356,325	20,588	5.8	360,171	23,606	6.6
1932	62,714	3,941	6.3	417,236	23,371	5.6	479,950	27,312	5.7

Converting exports of oil and of nuts into copra-equivalents, the following figures are obtained in metric tons:

	Oil: equivalent	Nut: equivalent	Copra Exports	Total
1928	55,199	13	440,851	496,063
1929	51,860	66	456,869	508,795
1930	21,246	48	375,717	400,011
1931	7,314	432	360,171	367,917
1932	27,283	423	479,950	507,656

World Production. Local consumption in the countries of production being unknown, no reliable figures can be given. The surplus, available for export, can however, be estimated. The principal exporting countries are: the Philippines, Netherlands India, British Malaya, Ceylon and Oceania.

The exports from all countries, converted into copra-equivalents, for 1928-1931 and also some incomplete 1932 figures are given in some detail, of which the following table is an extract.

	1928	1929	1930	1931	1932
Philippines ...	504,127	527,170	452,454	476,838	?
Netherlands India ...	496,063	508,795	400,011	367,917	507,656
Ceylon ...	235,844	238,225	219,697	237,385	188,396
Malaya ...	114,666	130,355	121,043	120,299	120,053
Balance of Asia ...	27,595	30,938	25,915	21,888	?
Oceania ...	175,997	205,192	200,200	185,747	?
Africa ...	50,769	51,368	54,636	55,103	?
America ...	30,094	49,624	34,642	34,155	?
Total ...	1,635,155	1,741,667	1,508,598	1,499,332 metric tons	

Essential Oils.

The only cultivated crop of any importance is citronella grass. The total planted area is: in hectares

estates Java	estates Outer Provinces	native Java	Total
9,044	284	11,179	20,507

The estates buy leaf as well as oil from the native growers and distillers. The native output of oil is unknown, owing to the very large number of small distillers and to the distilling by a great number of small growers themselves.

The total exports of citronella oil in 1932 were 996,107 kilograms, as compared with 892,895 kgs. in 1931, and an average annual export for the past 5 years of 945,336 kgs.

Hard rope Fibres.

This is an estate cultivation only, chiefly of sisal, in Java as well as in the Outer Provinces. The total exports of the last 5 years have been:

1928	1929	1930	1931	1932
50,306	58,686	65,666	70,278	90,588 metric tons.

Kapok.

This is predominantly a native crop. The cleaning of the fibre from the pods is largely a village industry. In Java there are 129 estates, cleaning their own produce and native produce purchased, and further, 83 cleaning plants, working purchased native produce only.

About 90 per cent. of the fibre and 80 per cent. of the seeds exported are native produce. All kapok seed oil and oil cakes are native produce. The 1932 exports were:

Fibre	Seeds	Oil	Oil cake
19,093	16,972	2,167	11,999 metric tons.

Netherlands India supplies 90 per cent. of the demand of the world market.

Cocoa.

The 1932 exports were 1,551 tons, of which 102 tons were native produce. The area under cultivation is slowly but steadily increasing. The quality of the product is good.

Pepper.

The cultivation is almost entirely in the hands of Chinese and native growers in Sumatra and Borneo; Java's output is negligible. Part of the exports from these two islands to Java is re-exported and part consumed locally. In 1932 these exports were: in metric tons.

		Black	White	Total
Sumatra and adjacent islands	...	17,023	13,499	30,522
Borneo	...	3,205	2,432	5,637
Celebes	...	14	—	14
		20,242	15,931	36,173

The total available world supply was 209,403 metric tons for the 5 years 1928-1932, of which Netherlands India supplied 152,160 metric tons, equal to 72.5 per cent.

Tapioca.

This crop is practically confined to Java and is predominantly a native crop. A small part of the native crop is milled in factories; the bulk of it is consumed locally and a comparatively small surplus only is exported in various forms.

Exports Tapioca Products (Metric tons).

	1928	1929	1930	1931	1932
Dried tubers ...	55,949	20,386	11,022	19,244	40,285
Dried ground ...	274,547	99,645	28,621	52,270	81,235
Flour ...	126,921	116,758	75,057	100,576	87,960
Flakes and Siftings ...	10,339	6,933	4,820	5,114	5,255
Pearl and Seed ...	26,652	19,055	10,879	14,633	11,124
Fibre-residue ...	10,222	7,507	4,626	1,257	586

The native area planted and the crops of raw tubers in these same 5 years have been:

	1928	1929	1930	1931	1932
Area in 1000 hectares ...	739	710	650	696	717
Production in 1000 tons ...	6,161	5,129	5,911	5,216	6,222*

Coca.

This is exclusively an estate crop and is exported as leaf. The production has been, in kilograms:

1928	1929	1930	1931	1932
455,677	485,407	363,000	252,085	154,101

Netherlands India is one of the chief suppliers of the world market.

Gambier.

This crop is grown in the Outer Provinces only; one quarter of the total is produced on estates and three-quarters by native and Chinese growers on

* The raw crop of 1932 having been slightly larger even than the bumper crop of 1928, the fact that 1932 exports remained far below those of 1928 is interesting and shows that in times of adversity the native population of Java can partly adjust itself to the need for economy by greater proportionate consumption of the cheaper home-grown food.—*Translator.*

the East Coast of Sumatra, Rhio and Borneo. The exports, including those to Java for native consumption have been : in metric tons.

	Estate production	Native production	Total export
1928	4,178	9,955	14,133
1929	4,342	9,317	13,659
1930	4,481	9,082	13,563
1931	3,226	10,979	14,205
1932	3,272	9,451	12,723

Arecanuts.

This is entirely a native crop. The chief exporters are Atjeh, East Coast of Sumatra and Java. An extract from the table, shewing the exports from the various parts of Netherlands India is given below in metric tons :

	1928	1929	1930	1931	1932
Achin ...	23,337	21,548	18,708	18,447	17,130
East Coast of Sumatra ...	7,548	9,057	10,896	10,018	10,066
Java ...	6,727	8,677	7,580	6,383	8,422
Other producers ...	8,346	7,407	5,412	4,337	4,144
Total ...	35,958	46,689	42,596	39,185	39,762

Nutmegs.

This information is incomplete and local consumption is unknown, but supposed to be considerable; so that the export figures represent an unknown part of the total production. There are 15 estates in Java—mostly in Mid-Java—, 1 in Menado—North Celebes—and 10 in the Moluccas. In Java, the crop is mostly interplanted, whilst outside Java is generally a sole crop.

In Java the planted area is 1341 hectares, of which 789 hectares are in bearing. For the Outer Provinces, the figures are respectively 950 and 829 hectares. For the whole of Netherlands India this gives an area of 2291 hectares planted, of which 1618 hectares are in bearing.

In addition to the estates, there is a native cultivation, the area of which is unkown, but the output of which is known to be considerable and in Banda Island alone amounted to 818 tons of nuts and 80 tons of mace.

Cloves.

The chief centres of cultivation are Benkoelen in Sumatra and the Moluccas. The larger part of the exports from the Outer Provinces goes to Java to satisfy an astonishingly large consumption, mainly needed for the manufacture of the cheapest kind of native cigarettes.* How large this consumption is will be clear from the fact that, apart from the supplies received from the Outer Provinces, Java imports have been as follows :—

Year	1928	1929	1930	1931	1932
Metric tons	3,112	2,235	3,038	5,173	2,051

of cloves from foreign countries.

Exports from the Outer Provinces were :

	To			Total exports to Java, other Islands and foreign countries combined				
	Java	Other Islands	Foreign Countries					
	1932	1932	1932	1928	1929	1930	1931	1932
Moluccas ...	235	50	63	273	400	340	336	348
Other ...	158	36	31	1041	421	652	633	215
Total ...	393	86	94	1314	821	992	969	573

Rice.

Only a very small part of the crop is exported. The Java crop, averaging 3,600,000 tons of husked rice, is not quite sufficient to satisfy local consumption and the Java imports in 1931 and 1932 amounted to respectively 231,702 and 275,684 metric tons.

The planted areas and the production of Java have been as follows :

	1928	1929	1930	1931	1932
Area in 1000 hectares ...	3,526	3,423	3,559	3,513	3,690
Production in 1000 metric tons ...	3,483.3	3,380.6	3,652.8	3,507.3	3,713.9

* They are made from a pinch of heavily sauced and doped coarse native tobacco, wrapped in a screw of the dried leaf of which the stem of the nipah palm is composed. There is not a ranker smoke in the whole wide world!—*Translator.*

In the above figures, husked rice is taken to be half the quantity of padi "in the ear". 88 per cent. of the planted area was wet rice land and 12 per cent. dry rice land: 93 per cent. of the crop came from the former and 7 per cent. from the latter. In 1932, the bulk of the harvest was reaped in May and June.

The import requirements of Java are, to some extent, satisfied by the export surplus of the Outer Provinces, chiefly Bali and Lombok. Celebes, which has a large export surplus, exports chiefly to other islands. These other islands, especially the East Coast of Sumatra, have to import large quantities from foreign countries.

The export of rice to foreign countries has been in metric tons:

	1928	1929	1930	1931	1932
Java ...	7,649	9,312	5,241	10,413	3,214
Outer Provinces ...	1,475	1,008	765	3,996	3,704
N.E.I. ...	9,124	10,320	6,006	14,379	6,918

Maize.

This is exclusively a native crop for domestic consumption. Three-quarters of the Java crop is grown on dry land and only one-quarter on the wet rice lands.

The Java figures for planted areas, production and export have been:—

	1928	1929	1930	1931	1932
Area in 1000 hectares ...	1,886	1,727	2,025	1,962	2,002
Production in tons of grain ...	1,943,100	1,576,400	2,002,900	1,910,800	1,902,300
Export in tons of grain ...	162,782	104,695	78,807	110,999	106,304

The figures for export (metric tons) from the Outer Provinces were:

54,844 69,195 43,518 57,291 67,186

Sago.

The figures for export to foreign countries were in metric tons:

	1928	1929	1930	1931	1932
East Coast of Sumatra ...	19,952	26,975	33,697	33,917	40,084
Rhio and Dependencies ...	11,233	12,157	9,629	8,845	10,115
West Borneo ...	1,707	2,783	8,061	2,757	3,074
Celebes etc. ...	140	143	160	180	34
Total ...	33,032	42,058	51,547	45,699	53,207

Export comes from the Western part of the Archipelago only, where sago is not the chief food supply as it is in the eastern part, notably the Moluccas.

Potatoes.

Planted areas and exports were as follows:

	1928	1929	1930	1931	1932
Java area in hectares ...	20,998	19,604	17,460	17,709	23,968
Java exports—metric tons ...	3,029	2,116	1,486	1,195	2,068
Outer Provinces exports— „	4,838	5,668	4,835	2,517	2,886
Total exports ...	7,867	7,784	6,321	3,712	4,954

Chillies.

In the Outer Provinces, this crop for export is of no importance. In Java, it is of some importance and the crop is chiefly planted on dry rice land; 72 per cent. against 28 per cent. on wet rice fields. From the latter, the crop is harvested in December, from the former in August.

Cotton.

Exports to foreign countries were in metric tons:

	1928	1929	1930	1931	1932
Java ...	647	543	558	974	485
Outer Provinces ...	938	1,036	820	706	746
Netherlands India ...	1,585	1,579	1,378	1,680	1,231

Practically the entire Java export is cleaned of seeds, and practically the entire export from the Outer Provinces is uncleaned.

L. A. J. R.

Conversion Table.

1 hectare = 2.471 acres. 1 kilogram = 2.2046 lbs.
1 metric ton = 1000 kilograms. 1 Eng. lb. = 0.454 kilogram.
1 English ton = 2240 lbs. = 1016 kilograms.
Yield: 1000 kgs. per hectare = 891⅓ lbs. per acre.

Miscellaneous Articles.

CONDITIONS ON SMALL RUBBER HOLDINGS IN MALAYA.

4th Quarter 1933

Prepared by the Economics Branch of the Department of Agriculture, S.S. and F.M.S. in collaboration with the Field Branch of the Department of Agriculture.

Rainfall.

In Perak the total rainfall for the quarter was very slightly below average, but the monthly totals showed variation from the average. October's precipitation was appreciably below the average whilst it was slightly above average for both November and December. In October the rainfall was fairly evenly distributed throughout the month, but the distribution was irregular in both November and December. The rainfall in Selangor was below the average in all districts during October and November, especially in the coastal districts, whilst in the inland districts during December, rainfall was slightly above average. Wet weather prevailed throughout the quarter in Province Wellesley, Penang and Dindings, the heaviest rainfall occurring in October when 35.83 inches were recorded in Penang.

On the east side of the Peninsula, the north-east monsoon had not broken at the end of November, although its influence was felt in the north-western area.

Prices.

Table I included in this article, shows the range of prices for the 4th quarter 1933, the Singapore average price for small-holders' rubber having remained fairly steady since August. The peak price for the year was secured in July when Singapore Standard Sheet sold for 14 11/16 cents per lb. and the small-holders' rubber averaged $17.50 per picul.

There was a decrease in price for all grades during August, September and October but the price firmed during November and December.

The quotations in the Table show the ruling prices from a large number of buying centres and it should be noted that such factors as transport and local competition affect the prices secured by the small-holder for his rubber.

The following Table shows the trend of average prices ruling in Singapore per picul at the end of each month for Kampong rubber during the year 1933.

Table I.

Rubber Prices [in Straits dollars per picul ($133\frac{1}{3}$ lbs.)]

4th Quarter, 1933.

	Singapore standard sheet Average	Singapore for small holder's rubber at end of month	Penang for small holder's rubber	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Province Wellesley	Kedah	Johore
					OCTOBER						
Smoked sheet.	17.25	15.50	—	10.50-15.90	13.00-16.50	12.80-15.75	10.50-17.00	13.00-16.00	13.50-16.00	12.50-15.50	10.00-16.20
Unsmoked sheet.		14.50	12.60-14.40	9.00-13.50	12.-0015.50	10.00-13.50	9.00-15.00	10.00-15.00	12.80-15.00	10.50-12.80	7.50-14.25
Scrap		5.00	5.20-6.50	1.00-5.50	3.00-6.00	.00-5.50	—	3.00-6.00	4.-006.50	3.50-7.00	1.80-6.00
					NOVEMBER						
Smoked sheet	17.51	16.50	—	11.50-15.80	14.00-17.00	12.00-16.50	12.00-16.00	13.00-16.00	13.00-18.00	13.00-15.20	10.00-16.20
Unsmoked sheet		15.00	12.00-14.20	10.00-14.30	12 00-14.50	10.00-14.00	10.50-14.80	11.00-14.50	11.00-17.00	10.00-13.50	7.50-14.50
Scrap		5.00	5.50-6.50	1.80-6.20	3.00-6.50	2.00-6.00	—	3.50-7.00	2.85-6.50	3.50-6.50	1.80-7.10
					DECEMBER						
Smoked sheet.	18.08	16.50	—	13.00-17.00	14.00-17.95	13.00-17.00	12.00-17.00	14.00-17.00	12.00-16.50	12.50-16.50	12.00-17.00
Unsmoked sheet.		15.50	13.50-14.60	10.50-14.25	12.0014.50	10.00-15.00	10.00-15.00	12.00-16.50	10.00-15.00	10.00-13.60	8.00-15.60
Scrap		5.50	5.00-6.20	2.75-6.00	3.00-6.00	2.50-5.00	—	3.50-8.00	3.00-6.00	4.00-6.50	1.50-6.50

Table II.

Average Singapore Prices for Rubber 1933.

	Smoked Sheet $	Unsmoked Sheet $	Scrap $
January ...	8.00	7.00	3.20
February ...	7.50	6.70	2.40
March ...	7.60	6.80	2.50
April ...	7.80	6.80	2.70
May ...	11.80	11.00	5.00
June ...	13.50	12.25	5.00
July ...	17.50	16.00	7.00
August ...	15.00	14.00	6.00
September ...	15.00	14.00	5.50
October ...	15.50	14.50	5.00
November ...	16.50	15.00	5.00
December ...	16.50	15.50	5.50

Tapping.

Reports from Penang state that, as compared with last quarter, tapping is on the increase, some holdings having started tapping twice daily, i.e. morning and evening and that there is a small increase in the total number of holdings, due to young holdings in the Dindings being newly brought into tapping; similar reports of young rubber being brought into tapping have been received from Pahang.

In the Krian and Selama districts of Perak, much of the tapping on small-holdings was done on the half-share system, tapping being usually on two or more panels.

Tapping in Malacca continued to be heavy owing to the prevailing good prices for rubber and the increase in the number of tapped holdings continued.

Areas out of Tapping on Small Holdings.

The method of estimating the area untapped among small-holdings by means of counting the number of such holdings along the sides of main roads was again employed, the result of this computation is shewn in Table III and was applied to the known area of tappable rubber, 1927 planting and earlier.

The total area of tappable rubber on estates of less than 100 acres which was untapped in the Federated Malay States in December 1933 is estimated on the foregoing system as amounting to approximately 45,000 acres as compared with 49,000 acres in September, 56,000 acres in June and 133,000 acres in March of this year.

The total area untapped in the Straits Settlements in December is estimated to be 14,000 acres as compared with 17,500 acres in September, 28,000 acres in June and 49,000 in March of this year.

Diseases.

Mouldy Rot.—In Penang and Province Wellesley North, mouldy-rot was prevalent towards the end of November and it was suggested that this outbreak might be connected in some way with movements of labour due to the present high prices of rubber.

The disease continued to be prevalent in all of the four western districts of Pahang, whilst no improvement was recorded in the position regarding the control of mouldy-rot in Perak, the response to efforts made to sell disinfectants being still very small. In Selangor there was a slight increase of mouldy rot infection during the quarter as a result of wet weather conditions and it was stated that control treatment was fairly well carried out, whilst in the Negri Sembilan the rainy season was responsible for a widespread distribution of the disease.

Pink Disease.—Some cases of this disease occurred in Province Wellesley and control measures were at once taken.

Root Disease.—It was reported that root diseases were fairly widely distributed throughout small holdings in Pahang, but that they did not result in any material damage.

Oidium Leaf Disease.—No reports were received in regard to this disease.

Grades of Rubber Made.

Figures of the percentages of the various grades of rubber produced, where these have been recorded, are as follows :—

PERAK : *Kuala Kangsar* :—(figures from 6 dealers) smoked sheet 32, unsmoked sheet 42, scrap 26.
Larut and Matang :—Smoked sheet 6, unsmoked sheet 70, scrap 23 and Lump 1.
Selama :—smoked sheet 80, unsmoked sheet 15, slab rubber and scrap 5.

PENANG and PROVINCE WELLESLEY : (figures from 26 dealers) smoked sheet 16, unsmoked sheet 70, scrap 14.

SELANGOR : *Kuala Langat* : smoked sheet 75, scrap 25.
Klang : smoked sheet 70, scrap 30.
Kuala Langat : smoked sheet 71, scrap 29.
Ulu Langat : smoked sheet 79, unsmoked sheet 8, scrap 13.
Ulu Selangor : smoked sheet 89, scrap 11.

MALACCA : *Central* : smoked sheet 29, unsmoked sheet 51, scrap 20.
Alor Gajah : unsmoked sheet 81, scrap 19.
Jasin : smoked sheet 21, unsmoked sheet 62, scrap 17.

Table III.

Estimated Acreage of Tappable Rubber which was out of Tapping on Holdings of less than 100 Acres, at the end of December, 1933.

PERAK

District	Total Tappable area	Total area untapped	Percentage
Batang Padang	37,288	1,000	3
Kinta	34,180	2,000	6
Kuala Kangsar	43,485	1,000	2
Upper Perak	13,774	1,500	11
Larut & Selama	51,407	5,000	10
Krian	9,751	2,000	21
Lower Perak	47,937	1,000*	2*
	237,822	13,500	6

SELANGOR

District	Total Tappable area	Total area untapped	Percentage
Klang	18,879	4,000	21
Kuala Langat	29,263	2,000	7
Ulu Langat	38,867	6,000	15
Ulu Selangor	30,632	1,000	3
Kuala Lumpur	21,174 }	3,500†	11†
Kuala Selangor	9,379 }		
	148,194	16,500	11

NEGRI SEMBILAN

District	Total Tappable area	Total area untapped	Percentage
Seremban	19,241	2,000	10
Tampin	17,947	2,000	11
Kuala Pilah	17,470	3,000	17
Jelebu	6,270	250	4
Port Dickson	10,653	1,000	9
	71,581	8,250	12

PAHANG

District	Total Tappable area	Total area untapped	Percentage
Raub	7,361	1,500	20
Kuala Lipis	15,951	1,000	6
Bentong	13.600	1,500	11
Other Districts	31,223	3,000	10
	68,135	7,000	10

MALACCA

District	Total Tappable area	Total area untapped	Percentage
Central	17,687	2,000	11
Alor Gajah	31,387	8,000	25
Jasin	24,971	250	1
	74,045	10,250	14

PENANG & P. WELLESLEY

District	Total Tappable area	Total area untapped	Percentage
North	3,241	100	3
Central	7,067	200	3
South	8,149	—	
Dindings	7,279	1,000	14
Penang	11,114	500	4
	36,850	1,800	5

SINGAPORE

District	Total Tappable area	Total area untapped	Percentage
Singapore	12,781	2,000	15
	12,781	2,000	15

The percentage of areas out of tapping in September, 1933, was as follows:—Perak 8, Selangor 8, the Negri Sembilan 16, Pahang 12, Malacca 15, Penang and Province Wellesley 9, Singapore 24.

* Estimated from same percentage as shown in Kuala Kangsar District.

† Estimated from mean percentage for remainder of State.

THE MALAYAN PINEAPPLE TRADE IN CANADA.*

Growth of Malayan Trade.

The Malayan canned pineapple trade in Canada has increased by 35.5 per cent. during the past five years, in 1932, 81.3 per cent. of the total imports of canned pineapples in that country being from the Straits Settlements. This increase has been mainly at the expense of the United States of America and Hawaii, whose combined imports into Canada have during the same period, decreased by 36.8 per cent. This situation is partly the outcome of the Ottawa Conference, whereby Empire produce is subject to an import duty of one cent (gold) per lb., as against five cents per lb. levied on the product from non-Empire countries.

On the other hand, the exports of pineapples from Malaya to Canada during 1932 amounted to only 85,000 cases, as compared with 219,000 cases in 1931, so that the reduced import evidently lay in the offtake of canned pineapples in general. The total imports of canned pineapples into Canada from all sources was 16,677,579 lbs. in 1932, 24,159,734 lbs. in 1931, 20,520,478 lbs. in 1930, 19,674,205 lbs. in 1929 and 15,054,834 lbs. in 1928.

Provisional figures for the first few months of 1933 seem to indicate a very considerable increase in imports, as well as a further developments in Malaya's relative share.

Position of Malayan Pineapples.

The Publicity Officer from the Malayan Information Agency took occasion to visit a large number of chain stores in Toronto, Ottawa and Montreal, and in each of these cities he found a different state of affairs. The one common feature was the absence of American and Hawaiian pineapples, which seem to have been virtually driven off the market.

In Toronto, the demand for canned pineapples seemed to be concentrated very largely on the "luxury" grades and, although there was a good demand for the Malayan product at about 11 cents (gold) per tin, there was an even better demand for Queensland pineapples at from 15 to 20 cents a tin. The possible explanation is that the poorer classes of Ontario have not yet learned to look upon pineapples as an article within their means.

In Ottawa, the public demand was divided between "luxury" and "cheap" with the preponderance, if any, in favour of the latter. Malayan pineapple was reported to enjoy a steady demand.

In Montreal, however, Malayan pineapples seemed to all intents and purposes to have a monopoly. Little or nothing else was to be seen in the shop windows, and the store-keepers asserted that the "luxury" trade was practically non-existent.

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* Abridged from the Report on the participation of Malaya at the Canadian National Exhibition, Toronto 1933, by the Publicity Officer of the Malayan Information Agency, London.

Relative Prices.

Special Sliced Malayan pineapple in 1½ lb. "talls" is shipped to Canada at present at an approximate price (c.i.f.) of 2s. 10½d. per dozen tins labelled, for minimum carloads of 500 cases and this is a considerably lower rate than that at which the product of any other country can be put on the market.

To arrive at an average retail price, however, is extremely difficult; in one store they were marked at two cans for 25 cents, in another at 10 cents a can and in a third it was 9 cents a can or three for 25 cents. The explanation was that the store first cited was temporarily short of pineapple stock and wanted to "mark time" with sales, while the third store was making a special "feature" of cheap pineapples in order to attract customers.

Graded Pineapple.

This commodity was brought to the attention of various distributors' representatives and also to a large number of retailers and store-keepers. All those who saw the graded pineapple were very impressed by its even colour and good appearance generally. None the less, they were unanimous in declaring that there is no place for it on the Canadian market if the certificate of grading involves any increase in price.

Crushed Pineapple.

The market for this commodity does not appear to have been explored nearly so fully as it deserves, and the demand is now likely to increase as the result of the Malayan participation at this Exhibition.

Several store-keepers stated that they had been approached for Malayan crushed pineapple but had been unable to supply it—had hitherto been unaware, in fact, of its existence. This is a matter which no doubt will soon be adjusted.

One distributor was of opinion that the rather higher cost of crushed pineapple will be likely to operate against its wide popularisation, though this might not be an insuperable obstacle if the public became genuinely interested. He was also of opinion that it would be necessary to have an absolutely distinctive label; also that the word "grated" must be eliminated and the grade simply termed as "crushed", which is the term used in the case of the Hawaiian and Australian products.

Pineapples in Cubes.

This commodity is practically unobtainable from Canadian stores, but there would appear to be a not inconsiderable potential demand. The opinion has been expressed in one quarter that the demand for cubes will never be strong enough to overcome the handicap of the higher price for this packing.

Pie-Fillings.

The Malayan representative at the Canadian National Exhibition was approached by a firm who for some time past has done a considerable business in the importation of frozen fruits for pie-fillings.

It appears that the firm applies to this business a special patent process. The peculiar value of this process, it is claimed, lies in the fact that the frozen fruit will remain good for a lengthy period after being removed from cold storage.

The firm is anxious to add crushed pineapple to the list of pie-fillings which it imports, but has been prevented hitherto by the high price of Hawaiian fruit. Ordinary canned crushed pineapple is unsuitable; it has too high a liquid content. It is thought, however, that a good volume of business could be developed by the application of the process to crushed pineapple in Malaya, and the firm in question would be willing to explain it to a reliable firm if satisfactory arrangements could be made.

Conclusion.

The conclusion would seem to be that there will definitely be room for expansion of the market in Canada for low-priced foodstuffs such as Malayan canned pineapple; while to this it should be added that the Malayan fruit, provided it continues its present improvement in respect of quality, flavour and grading, ought to be able also to secure at least some share of the "luxury" trade.

INTERNATIONAL GROCERS' EXHIBITION, 1933.*

The Exhibition was held at the Royal Agricultural Hall, Islington from September 16th to 23rd.

Once again, a comprehensive display of Malayan canned pineapples was rendered possible by the co-operation of various importing firms who provided free samples of this product. In addition to pineapples, exceptionally good samples of tapioca were on view and attracted favourable notice.

This being purely a trade show, propaganda was aimed primarily at the retail grocer, as opposed to the consumer. With Malaya already providing almost 94 per cent. of the canned pineapple annually imported in to the United Kingdom, it is self-evident that little scope remains for the expansion of Malaya's proportionate share of the market. It is a recognised principle of advertising, however, that a commodity must continue to be kept before the public attention

* Abstract from a report by H. S. Banner, Publicity Officer, Malayan Information Agency, London.

however firmly it may seem to be established. Moreover, such exhibitions as this provide an opportunity for demonstrating that Malayan pineapple is making steady advancement in regard to quality, flavour and grading.

The quality of pineapple supplied for this Exhibition was the best sample of the product handled during the writer's experience extending over the past six years. Such improvement must be maintained if we are to keep the enviable place on the market which we have won.

As the position is at present, the retailer has learned that it definitely pays to stock Malayan pineapples. One buyer who visited the stand—a man who deals in 2,000 case lots—stated that he had first commenced to stock the Malayan product, in place of that of a competing country, after its introduction to his notice at this same exhibition two years ago. His trade has increased by 100 per cent. since he took this step.

The volume of new business brought about through the agency of the Malayan Stand naturally grows less each successive year—"naturally", because of Malaya's almost monopolistic position on the market at the present time. Nevertheless, a fair number of new connections for medium-sized lots were effected.

Reviews.

Malayan Agricultural Statistics, 1932.

By D. H. Grist. Special Bulletin, Department of Agriculture, S.S. and F.M.S., Economic Series No. 3. 74 tables, 2 graphs. 1933. Price 50 cents.

This Bulletin contains statistical data concerning Malayan agriculture and brings up to-date, the information published in Bulletin No. 1 of the Economic Series of this Department respecting the year 1931.

It is compiled by the Economic Branch and in the course of its preparation, use has been made of data compiled by other Departments of Government, notably the Customs, Statistics and Veterinary Departments, and the Meteorological Branch of the Survey Department.

The present edition is considerably larger than the previous edition. It contains 11 additional tables, while a number of footnotes have been added which further explain the figures and give information respecting the more important countries of import and export.

The bulletin attempts to present a statistical review, over a number of years, of Malayan agricultural industries and trade. It not only shews the developments that have taken place, but demonstrates the local market which exists for products suitable for cultivation in Malaya, but of which large quantities are imported.

In addition, statistical information is given of areas and distribution of crops in Malaya, yields and market prices.

The M.A.H.A. Magazine.

The M.A.H.A. Magazine, published monthly, is the official organ of the Malayan Agri-Horticultural Association and the Selangor Gardening Society. The January number (Vol. IV, No. 1) contains a number of articles of interest to those to whom gardening is a hobby and also to a wider public who are engaged in various aspects of agriculture. The original articles included in this number are on Hedges; Insect Pests of Ornamental Plants; New or Interesting Ornamental Plants; The Control of Rural Malaria; Rainfall Recording; and Milk Production in the Tropics and the Value of Pasteurisation.

The Magazine costs 36 cents post free, or $1.20 per annum and is good value for the money. Subscriptions should be addressed to the Editor, M.A.H.A., 12 Barrack Road, Kuala Lumpur.

Departmental.

FROM THE DISTRICTS.

The Weather.

The month was characterised by an unusual period of wet weather, giving a rainfall much above the average in all parts of the Peninsula except in the States of Kedah and Kelantan and a few other localities including Cameron Highlands. The wet period occurred generally during the first fifteen days to three weeks of the month; but in Krian and Larut Districts of Perak and on Cameron Highlands the middle ten days constituted the wet period. While Krian and Larut Districts experienced a heavy rainfall, minor floods occurred in Pahang and more severe floods in Johore and Singapore Island. Strong North-East Monsoon winds were prevalent.

Remarks on Crops.

Rubber.—The average price of rubber rose as a result of the increasing possibility that a restriction scheme would, before long, materialise. The highest and lowest prices in dollars and cents per picul recorded during the month for rubber from small holdings were:—Smoked Sheet \$12.50 to \$19.50; Unsmoked Sheet \$10 to \$18; Scrap \$1.50 to \$7.25. The average Singapore prices for these grades were respectively \$19, \$17.50 and \$6 as compared with \$16.50. \$15.50 and \$5.50 in December. Penang prices for Unsmoked Sheet ranged from \$13.50 to \$16.50 as compared with \$13.30 to \$14.60 in December.

Two opposing tendencies were manifest during the month. On the one hand, the increase in the price of rubber and the need of ready money for the expenses of the Mohamedan New Year festivities tended to increase production, through further additions to the number of properties in tapping and by the wider use of somewhat severe tapping methods. On the other hand, wet weather, padi harvest, and the incidence of part of the fasting month with the following new year celebrations, tended to reduce production by restricting tapping, while the commencement of wintering and high winds in the dry weather at the close of the month reduced the yield of rubber from the trees tapped.

In Kelantan, the movement towards improving the quality of the rubber produced on small holdings is extending.

Padi.—The price of padi at the Government Rice Mill, Bagan Serai, was fixed at \$1.50 per picul, a fall of 12 cents per picul as compared with that of December. This reduction is in sympathy with the prevailing low price in the world's markets. The price at this mill was, however, better than that offered by private millers in Kedah, where it varied from \$1.10 to \$1.15, or in Penang Settlement, where it was \$1.25 per picul. In other parts of the country, the price has ranged from 5 to 15 cents per gantang in the villages, the most usual prices being 5 to 9 cents.

Harvest was in full progress in Kedah, Penang and Province Wellesley, Krian and Malacca where yields so far obtained have been good. Except in

Kedah, high winds and rain caused rather extensive lodging; on the whole, however, yields did not suffer, though in Malacca the quality of some of the grain was affected by the wet weather.

In the later planted areas in Larut, Kuala Kangsar and Upper Perak Districts of Perak the rain improved the crop, but in the Kuala Pilah District of Negri Sembilan floods did some damage.

In Kelantan, a good crop of dry padi was harvested, but the wet padi crop is likely to be poor.

Coconuts and Copra.—The price of copra remained very low at \$2.20 to \$2.40 in Penang and \$1 to \$3 per picul elsewhere.

While Malays continued to show interest in the preparation of improved copra, more especially in Province Wellesley, Krian and Johore, there was little definite progress to record during the month.

Pineapples.—Comparatively little canning was done in Johore and Singapore during the month owing to the scarcity and consequent high price of fresh fruits which sold at prices up to \$3 per 100 fruits of first quality. This is a high figure in proportion to the present low price obtainable for the canned product.

The reduction in supply is mainly attributed to reduction of the area planted as a catch crop without a compensating increase in the area planted as a sole crop. It is considered, however, that a reduced yield from areas of older plants grown without manuring and also, possibly, the climate during the present season are contributing causes.

Fruit.—Fairly heavy crops of the main tree fruits were obtained in the Bentong District of Pahang, but only small crops in Kuala Lipis District. In the Negri Sembilan and Singapore Island, the season was drawing to a close. In Kedah, large supplies of water melon were on sale in the local markets.

Tobacco.—Prices for sundried tobacco leaves have ranged from \$14 to \$40 for first quality and \$8 to \$20 per picul for second quality in most areas. In parts of Johore the price for first quality leaf was as high as \$65 per picul, while in Province Wellesley the top price was only \$22 per picul. There was a tendency to reduce the planted area in Province Wellesley, Malacca and Selangor. In the Province, food crops are being substituted for tobacco, while in Malacca, Chinese padi and vegetable growers are using chillies in preference to tobacco as an inter-season crop.

Further flue curing trials at the Pineapple Experiment Station in Singapore during the month resulted in the production of a leaf of good colour, but of poor quality. The leaves were mainly obtained from untopped plants grown for seed and were, in consequence, small and thin, though comparatively easy to cure effectively. After harvesting the leaves yellowed naturally in one to one and a half days and the fixing and drying processes occupied only a further two days. The proportion of yellow leaf obtained was very satisfactory.

Arecanuts.—While in most parts of the Peninsula the price of dried arecanuts remained very low, it was somewhat better in Malacca, where a revival of interest and a fairly brisk trade in nuts was reported.

In interesting minor industry exists in the Muar District of Johore. Chinese from Kelantan and Trengganu visit this District in the cropping season and prepare salted arecanuts for export to Hong Kong and Shanghai and thence to the interior of China. The Chinese buy the ripe fruit and pack it with salt into large baskets holding about 1½ piculs. The fruits are well rammed down and the baskets are then shipped to Singapore for export to China. At the end of the season, the Chinese return to the North East coast where the arecanuts ripen later than in Johore.

Vegetables.—Preparation of the land for the cultivation of vegetables was proceeding in many parts of Kelantan. As a new development, some plots of vegetables will be planted in the padi fields of Pasir Puteh District after the padi harvest. In Singapore Island, considerable damage was done by floods to many of the vegetable-growing areas during the first half of the month; in some localities practically a total loss of the growing vegetables was recorded.

Agricultural Stations.

The various experiments with tea at the Government Experiment Station, Tanah Rata, have not been in progress long enough to give reliable results, but it may be mentioned that the first records from manurial experiments with various fertilisers indicate that an adequate supply of nitrogen is the most important factor in maintaining the vigour and yield of the bushes. The analysis of the first year's records from an experiment on pruning intervals for mature tea indicates an interval of at least 3½ years between prunings may be allowed and that manuring is advantageous when tea is kept in bearing for this period.

A second break of 68 half chests of tea was ready for despatch to England early in February.

The fowls recently imported from England for this Station have given a large number of eggs, varying according to breed from an average of 19 to 23 per pullet for the month. Of these eggs, 52 per cent. were over 2 ozs. each and 48 per cent. between 1½ and 2 ozs.

At the Central Experiment Station in Kelantan, the plots of the manurial experiment with dry padi were harvested. In spite of difficulties resulting from wet weather and damage from rats sheltering under the lodged crop, good yields, averaging over 340 gantangs per acre, were obtained.

Padi Test Plots.

Harvesting of manurial and other experiments was completed at the Padi Test Plots at Langgar, Jitra and Rantau Panjang in Kedah. At the first two Plots there were some excellent plot yields. Stores of the local type (Malay: kepok) were erected for padi seed for distribution at Langgar and Jitra at small

cost. Harvest was also in progress at the Kuala Kurau Padi Test Plot in Krian, where lodging had resulted from the strong winds and rains experienced about the middle of the month. Notwithstanding this, crops were good, those reaped averaging about 600 gantangs per acre.

Harvest was also completed at the Tangkak, Labis and Segamat Padi Test Plots in Johore. At the first two Plots the pure strains of padi ripened before the local varieties both on the Plots and in the surrounding padi fields. Consequently they suffered severely from the attacks of birds. The local varieties gave yields of about 500 gantangs per acre as compared with 200 to 240 gantangs per acre from the damaged pure strains. At the Segamat Plot, Siam 29 and Siam 76 yielded at the rate of 300 gantangs per acre as compared with 210 and 180 gantangs per acre respectively from the local Serendah Kuning and Serendah Puteh.

Rural Lecture Caravan.

The Caravan visited four centres in Ulu Selangor District during the month, staying two days at each. Lectures illustrated by models and lantern slides were given on housing and care of poultry. Large audiences attended and showed much interest in the lectures.

NOTE.

Manuring of Sugar Cane in British Guiana.

In the introduction to Part I of the series of articles on studies of Malayan soils which appeared in the August 1933 number of this Journal, a statement was made concerning sugar cane soils in Demerara.

In a recent letter to the Director of Agriculture, S.S. and F.M.S., Professor J. Sydney Dash, Director of Agriculture. British Giuana writes as follows:—

> " I do not think British Guiana is ever likely to use pen manure and her yields have steadily increased during the last three years by nearly a ton of sugar per acre due to increased tillage, increased use of flood fallowing and increased use of commercial fertilisers ".

It may be pointed out that in the article in question there was no intention of suggesting that British Guiana was likely to be in a position to use pen manure. the situation in that country presumably being, in certain respects, parallel with Malaya where it may be regarded as practically certain that the extensive use of pen manure is, from the nature of conditions, hardly likely ever to become generalised.

The effect of flood fallowing as practised in Demerara as part of procedure for restoring soil fertility seems to be a point of particular interest.

H. A. T.

DEPARTMENTAL NOTES.

Visits and Tours.

On January 19th and 20th the Director of Agriculture visited the Negri Sembilan and Malacca where he inspected the Agricultural Stations and discussed various questions with the Agricultural Officers. He also conferred with the Resident Councillor, Malacca.

From January 20th to 29th the Director of Agriculture paid an official visit to Johore, at the request of the Government of the State, for the purpose of inspecting the agricultural services and of reporting to the Johore Government on measures to be adopted for their extension. During the period the Director conferred with the General Adviser and with Assistant Advisers and Agricultural Officers and visited all districts throughout the State.

On January 22nd the Director of Agriculture attended a meeting of the Executive Council in Singapore for the purpose of discussing questions relating to the rice industry in the Straits Settlements with His Excellency the Governor and members of the Council.

The Chief Field Officer paid a visit to Singapore on January 19th to see the packing of a trial consignment of graded canned pineapples and inspect the Pineapple Experiment Station.

The Acting Agricultural Chemist paid a visit to Oil Palm Plantations Ltd., Johore, on 21st to 23rd January.

The Assistant Chemist for Copra Research visited Bagan Datoh, Perak and Sabak Bernam, Selangor, on 15th and 16th of the month to give advice concerning the reconstruction of kilns on a coconut estate and to survey the conditions of copra manufacture on small holdings.

Central Experiment Station.

From January 1st 1934, the Government Experimental Plantation, Serdang will be known as the Central Experiment Station, Serdang.

Appointment.

Mr. N. H. Sands has been appointed Acting Agricultural Officer, Perak Central. He assumed duty on January 8th 1934.

Leave.

Mr. H. D. Leighton, Agricultural Officer, has been granted full pay leave for 4 months, 15 days with effect from January 8th., on expiry of agreement.

Statistical.

MARKET PRICES

January 1934.

Rubber.—The market price of rubber has fluctuated during the month, opening at $13\frac{5}{8}$ cents per lb. for Spot loose in Singapore and closing at $15\frac{7}{8}$ cents per lb. The average price for the month was $14\frac{1}{2}$ cents per lb. in Singapore, 4 13/32 pence in London and $9\frac{1}{8}$ cents Gold in New York as compared with 13 9/16 cents, 4 3/16 pence and 8 11/16 cents Gold respectively in December 1933.

Palm Oil.—The course of the market Liverpool/Continent during January on a basis of 5 per cent. f.f.a., c.i.f. was as follows: January 3rd £15 per ton net, January 17th £14 per ton net, and January 24th £14 per ton net.

Prices in the U.S.A. landed weight per pound in bulk c.i.f. New York/ Philadelphia were 2.65 cents Gold on the 3rd January, 2.70 cents Gold on 17th January and 2.60 cents Gold on the 24th January.

The price of palm kernels Fair Average Malayan Quality c.i.f. landed weight on the Continent was shillings $7/4\frac{1}{2}$ per cwt. on January 3rd.; shillings 7/3 per cwt. on January 17th. and shillings 7/3 per cwt. on January 24th.

Copra.—There was a further slight fall in price during January. The highest Singapore price for Sundried during the month was $3 per picul, and the lowest price $2.90 per picul, the average price per picul being $2.94 as compared with $3.08 during December. The mixed quality averaged $2.29 per picul as compared with $2.40 per picul in December.

Coffee.—The price at Singapore for Sourabaya coffee remained fairly steady, prices ranged according to grade, from $17 to $19. Palembang Coffee averaged $13.12 per picul during the month, being quoted at $13.50 on the 1st. and a similar price on the 26th; the average figure for December was $12.25.

Arecanuts.—Palembangs averaged $2.94 per picul and Bila Whole $5.75 per picul as compared with $1.96 and $2 per picul during December, the rise in price being very considerable. The range of Singapore prices for other grades was Split $2.25 to $4 per picul; Sliced $6 to $7.50 per picul and Kelantan $3 to $4.50 per picul.

Rice.—The average wholesale price of Siam No. 2 ordinary rice per picul in Singapore in December was $3.18 per picul as compared with $3.31 in November. No. 1 Rangoon rice averaged $3.11 per picul in Singapore in December, the average price for November being $3.10 per picul.

The average retail market prices in cents per gantang of No. 2 Siam rice in December were:—Singapore 23, Penang 26, and Malacca 24 as compared with 24, 27 and 27 respectively in November.

Tea.—During December the average price quoted in London for Malayan tea was shillings 1/1.86. Average prices during December for tea consign-

ments from other countries were as follows:—Ceylon, shillings 1/3.32; Java, pence 11.16; Indian Northern, shillings 1/1.61 and Indian Southern, shillings 1/1.86.

Gambier.—The price of Block gambier remained steady during January, averaging $3.85 per picul, Cube No. 1 averaged $6.35. Corresponding figures for December were $4 and $6.50 respectively.

Pineapples.—There was a further slight increase in value during January, the average Singapore price per case being as follows:—Cubes $3.17, Sliced Flat $3.05 and Sliced Tall $3.13, as compared with $3.14, $3.04 and $3.10 respectively during December.

Tapioca.—The price of Flake Fair averaged $4.85 per picul as compared with $4.45 in December. Pearl Seed averaged $5.60 per picul and Pearl Medium $6 per picul both slight increases on the average prices in December, namely $5.42 and $5.70.

Sago.—Pearl-small Fair again increased slightly in price during January, averaging $3.94 per picul during the month; the price was $3.90 in December. Flour-Sarawak Fair averaged $1.92 per picul as compared with the December average of $1.79 per picul.

Mace.—Prices were nominal during January, the average for the month for Siouw being $65 per picul and $40 for Amboina.

Nutmegs.—100's averaged in price during January $20 per picul, having averaged $19.60 per picul during the previous month; 80's again fell in value, averaging $23.60 per picul, against the figure of $24.40 per picul in December.

Pepper.—Average Singapore prices during January were as follows:—Singapore Black $15.30 per picul; Singapore White $30.50 per picul and Muntok White $32.60; the corresponding figures for December were $13.30, $22.60 and $23.60 per picul respectively.

Cloves.—There was a further fall in the average price of Zanzibar during January as compared with the December price; the January average was $35 per picul. Amboina continued steady as in the previous months at $45 per picul. These are nominal prices.

Tuba Root.—Prices are again firm. Good Rotenone-containing roots averaged $30.50 per picul, while good qualities on the Ether extract basis averaged $24.00.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co., Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Mackie & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY.*

December, 1933.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during December 1933, amounted to 49,168 tons as compared with 57,402 tons in December 1932, of which 46 per cent. were consigned to Singapore, 18 per cent. to Penang, 9 per cent. to Malacca, 23 per cent. to the Federated Malay States and 4 per cent. to the Unfederated Malay States.

Of these imports, 63 per cent. were from Siam, 24 per cent. from Burma, 9 per cent. from Indo-China and 4 per cent. from other countries.

Total foreign exports of rice from Malaya in December 1933, were 10,579 tons (including 115 tons local production) as compared with 17,876 tons in December 1932.

Of these exports 69 per cent. were consigned to Netherlands India and 31 per cent. to other countries.

Net imports for the period January to December 1933, were 433,956 tons as compared with 409,631 tons during the same period for 1932, an increase of 5.9 per cent.

India and Burma.—Total foreign exports of rice during November 1933, were 103,000 tons as compared with 91,000 tons in the previous month and 100,000 tons in November 1932, an increase of 12 per cent. in respect of the previous month and an increase of 3 per cent. in respect of the same period in the previous year.

Total exports during the period January to November 1933, were 1,758,000 tons as compared with 1,966,000 tons for the corresponding period of 1932, a decrease of 11 per cent.

Siam.—The area under padi at the end of November, 1933, in Siam was 7,542,400 acres as compared with 7,457,200 acres in the previous season. The area damaged was 428,000 acres. The total production was 4,790,100 tons. The surplus available for export is now estimated at 1,641,000 tons of rice and rice products.

Netherlands India, Java and Madura.—At the end of November 1933, the area harvested amounted to 9,096,000 acres an increase of 171,000 acres or 2 per cent. as compared with the corresponding date of 1932; the area damaged was 446,000 acres an increase of 85,000 acres or 24 per cent. as compared with 1932, and additional plantings awaiting harvesting amounted to 2,070,000 acres an increase of 278,000 acres, or 16 per cent. The total acreage at the end of November 1933, amounted to 11,612,000 acres, an increase of 534,000 acres or 5 per cent. as compared with the same period in 1932.

Imports of rice into Java and Madura during January to October 1933, totalled 104,465 tons, a decrease of 17,779 tons or 14 per cent., as compared with the same period of 1932.

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*Abridged from the Rice Summary for December 1933 compiled by the Department of Statistics, S.S. and F.M.S.

Imports of rice into the Outer Provinces during January to October 1933, amounted to 211,201 tons, a decrease of 8,488 tons or 4 per cent., as compared with the same period of 1932.

French Indo-China.—Entries of padi at the port of Cholon from January to December, amounted to 1,086,000 (metric) tons, a decrease of 27,000 tons or 2 per cent. as compared with the same period of 1932.

Exports of rice from Saigon for the period January to December 1933, totalled 1,221,000 tons, an increase of 29,000 tons or 2 per cent. as compared with the corresponding period of 1932.

Ceylon.—Imports for the period January to November 1933, totalled 398,996 tons, a decrease of 471 tons on the imports for the same period of 1932.

Of these imports 19 per cent. were from British India, and 89 per cent. from other countries.

Europe and America.—Quantities of rice shipped from the East were :—

(*a*) To Europe for the period January 1st to December 20th, 1,233,493 tons, an increase of 223,238 tons or 22 per cent. as compared with the same period of 1932. Of these shipments 46 per cent. were from Burma, 2 per cent. from Japan, 44 per cent. from Saigon, 7 per cent. from Siam and 1 per cent. from Bengal as compared with 52 per cent. from Burma, 2 per cent. from Japan, 38 per cent. from Saigon, 5 per cent. from Siam and 3 per cent. from Bengal in 1932.

(*b*) To the Levant, period January 1st to November 18th 1933, 23,993 tons a fall of 24,069 tons or 50 per cent. as compared with the same period of 1932.

(*c*) To America and the West Indies for the period January 1st to November 26th 1933, 157,543 tons an increase of 39,177 tons or 33 per cent. as compared with the same period of 1932.

MALAYAN PRODUCTION OF PALM OIL AND KERNELS FOURTH QUARTER, 1933.

(As declared by Estates).

	Palm Oil		Palm Kernels	
	F.M.S.	Johore	F.M.S.	Johore
	Tons	Tons	Tons	Tons
1933 October ...	896.0	331.6	154.0	61.0
November ...	851.2	291.8	143.0	50.8
December ...	887.5	225.0	157.5	37.5
Ttotal ...	2634.7	848.4	454.5	149.3

MALAYAN AGRICULTURAL EXPORTS, DECEMBER, 1933.

	Net Export in Tons.			
	December 1932	December 1933	Year 1932	Year 1933
Arecanuts ...	1,731	670	20,288	20,756
Coconuts fresh† ...	11,610	6,507	109,536	100,609
Coconut oil ...	1,281	1,419	11,949	17,568
Copra ...	6,768	13,577	97,277	110,543
Gambier, all kinds ...	172	266	2,926	2,560
Palm kernels ...	150	170	1,248	1,983
Palm oil ...	592	1,635	7,892	12,101
Pineapples, canned ...	6,231	5,242	66,291	59,582
Rubber§ ...	40,974	45,205	417,137	459,836
Sago,—flour ...	974	1,614	8,994	7,648
„ —pearl ...	176	369	3,156	2,646
„ —raw ...	315*	503*	4,199*	4,420*
Tapioca,—flake ...	682	696	9,028	9,881
„ —flour ...	284	332*	393	702*
„ —pearl ...	1,409	1,050	19,879	17,297
Tuba root ...	39½	71½	167	569½

† hundred in number. § production. * net imports.

MALAYA RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING DECEMBER, 1933

STATE OR TERRITORY	Acreage of Tappable Rubber end 1932	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
STRAITS SETTLEMENTS :—							
Province Wellesley	44,734	1,323	3.0	7,317	16.4	8,640	19.4
Dindings	6,969	209	3.0	759	10.9	968	13.9
Malacca	111,780	4,642	4.2	16,881	15.1	21,523	19.3
Penang Island	1,635	626	38.3	100	6.1	726	44.4
Singapore Island	28,269	9,484	33.5	4,919	17.4	14,403	50.9
Total S.S. ...	193,387	16,284	8.4	29,976	15.5	46,260	23.9
FEDERATED MALAY STATES :—							
Perak	250,951	4,398	1.8	34,156	13.6	38,554	15.4
Selangor	308,379	6,490	2.1	40,549	13.2	47,039	15.3
Negri Sembilan	228,541	7,510	3.3	20,505	9.0	28,015	12.3
Pahang	38,141	5,892	15.4	6,293	16.5	12,185	31.9
Total F.M.S. ...	826,012	24,290	2.9	101,503	12.3	125,793	15.2
UNFEDERATED MALAY STATES :—							
Johore	325,747	21,711	6.7	32,912	10.1	54,623	16.8
Kedah (a)	114,551	3,784	3.3	7,370	6.4	11,154	9.7
Kelantan	21,175	6,237	29.5	2,227	10.5	8,464	40.0
Trengganu (b)	4,352	Nil	Nil	1,561	35.9	1,561	35.9
Perlis (a)	957	177	18.5	468	48.9	645	67.4
Total U.M.S. ...	466,782	31,909	6.8	44,538	9.5	76,447	16.4
TOTAL MALAYA ...	1,486,181	72,483	4.9	176,017	11.8	248,500	16.7

Notes :—(*a*) Registered companies only and are rendered quarterly.
(*b*) Registered companies only.
The above table together with a Summary, was prepared and published by the Statistics Department, S.S. and F.M.S. in January, 1934.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF DECEMBER 1933 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month		
								during the month		January to Oct 1933		during the month		January to Dec. 1933				
	Ports	Dealers	Estates of 100 acres and over	during the month	January to Dec. 1933	during the month	January to Dec. 1933	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States ...	...	12,983	11,958	12,926	137,363	11,030	110,848	Nil	Nil	Nil	Nil	18,179	5,255	180,004	70,546	...	12,715	12,728
Johore ...	...	3,196	3,244	4,324	44,237	4,748	53,065	Nil	3	Nil	124	1,631	7,397	17,101	79,840	...	3,305	3,182
Kedah ...	...	506	2,234	2,294	28,682	3,698	18,910	Nil	Nil	Nil	Nil	1,655	3,338	15,487	31,634	...	538	3,201
Perlis ...	...	21	14	16	108	45	213	Nil	Nil	Nil	Nil	Nil	53	Nil	323	...	28	15
Kelantan ...	...	309	188	196	2,225	251	6,074	79	Nil	1,128	Nil	68	537	976	8,314	...	215	203
Trengganu ...	...	55	50	90	1,638	45	818	Nil	Nil	Nil	Nil	Nil	135	Nil	2,456	...	55	50
Total Malay States	...	17,070	17,688	19,846	214,253	19,817	189,928	79	3	1,128	124	21,533	16,715	213,568	193,113	...	16,856	19,379
STRAITS SETTLEMENTS :-																		
Malacca ...	...	2,943	1,285	1,561	16,338			Nil		15		3,929		48,884		...	2,734	1,293
Province Wellesley	...	1,307	588	629	6,366			Nil		Nil						...	1,067	602
Dindings ...	...	53	202	122	1,223	3,933	30,711	Nil	16,829	Nil	193,892	8,544	Nil	80,608	Nil	...	59	154
Penang ...	3,995	5,764	9	14	73			1,957		11,380						2,354	5,465	8
Singapore ...	2,542	31 662	123	190	1,851			11,734		115,191		23,573		230,352		5,955	31,110	149
Total Straits Settlements	6,537	41,729	2,207	2,516	25,851	3,933	30,711	13,691	16,829	126,586	193,892	36,046	Nil	359,84[illegible]	Nil	8,309	40,435	2,206
TOTAL MALAYA	6,537	58,799	19,895	22,362	240,104	23,750	220,639	13,770	16,832	127,714	194,016	57,579	16,715	573,412	193,113	8,309	57,291	21,585

TABLE II

DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
20	21	22	23	24	25	26
DRY RUBBER	9,227	26,458	4,467	3,706	1,290	165
WET RUBBER	3,488	4,652	998	154	2,015	373
TOTAL ...	12,715	31,110	5,465	3,860	3,305	538

TABLE III

FOREIGN EXPORTS

PORTS	For month	January to Dec. inc. 1933
Singapore ...	35,522	353,663
Penang ...	14,048	130,818
Port Swettenham.	7,298	77,199
Malacca ...	711	11,732
MALAYA ...	57,579	573,412

TABLE IV

DOMESTIC EXPORTS 4

AREA	For month	during the year 1933
Malay States ... Straits Settlements	43,271	448,690
MALAYA ...	43,271	448,690

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + 20 tons local consumption during the month —[2]—[3]—[4]—[5]—[9]—[10]. For the Straits Settlements, Columns [9] and [10] represent purchases by dealers from local estates of less than 100 acres, reduced by 15 % to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15; wet sheet, 25 ; scrap, lump, etc., 40 %; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5 The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 23rd January 1934.

METEOROLOGICAL SUMMARY, MALAYA, DECEMBER, 1933.

Locality	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total		Most in a day Amt.	Number of days: Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total	Daily Mean	Per cent
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.								
Railway Hill, Kuala Lumpur, Selangor ...	88.6	70.8	79.7	92	68	82	73	82.5	83.7	13.56	344.4	2.25	22	19	4	11		152.15	4.91	41
Bukit Jeram, Selangor ...	86.5	71.6	79.0	89	70	80	74	82.1	84.2	7.04	178.8	2.46	17	15	1		1	153.20	4.94	41
Sitiawan, Perak ...	86.6	71.3	78.9	91	67	78	74	82.2	84.0	6.08	154.4	3.00	16	14	1	1		142.95	4.61	39
Temerloh, Pahang ...	84.8	72.0	78.4	88	69	78	74	82.3	84.4	8.33	211.6	1.86	21	15		1		129.40	4.17	35
Kuala Lipis, Pahang ...	83.9	70.8	77.3	89	69	77	73	81.3	82.9	5.72	145.3	1.97	23	19		23		110.30	3.56	30
Kuala Pahang, Pahang ...	82.1	72.9	77.5	85	70	76	75	79.5	81.7	21.65	549.9	5.33	24	22				135.55	4.37	37
Mount Faber, Singapore ...	84.7	71.5	78.1	89	69	80	73	79.1	80.6	4.49	114.1	0.84	18	14	1			136.65	4.41	36
Butterworth, Province Wellesley ...	86.1	72.4	79.3	89	70	83	74	82.8	84.0	4.35	110.5	1.85	9	9	1	2		180.15	5.81	49
Bukit China, Malacca ...	84.4	72.5	78.5	87	71	78	74	80.6	82.0	9.02	229.1	3.06	15	12	2			151.00	4.87	41
Kluang, Johore ...	84.9	71.0	77.9	89	69	74	73	79.9	81.2	7.35	186.7	2.18	17	15		4		129.55	4.18	34
Bukit Lalang, Mersing, Johore	81.8	71.6	76.7	85	69	77	73	78.7	79.9	9.96	253.0	2.08	21	18		2		132.65	4.28	
Alor Star, Kedah ...	87.0	70.8	78.9	91	67	79	74	82.9	84.3	4.18	106.2	1.84	14	9	2			176.10	5.68	48
Kota Bahru, Kelantan ...	82.9	72.1	77.5	87	69	77	74	80.3	82.1	29.14	740.2	5.88	19	18				131.80	4.25	36
Kuala Trengganu, Trengganu	82.0	71.7	76.9	85	70	73	74	78.7	79.7	30.27	768.9	6.89	24	20		1		127.85	4.12	35
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. Pahang ...	69.9	60.3	65.1	74	58	62	62	70.2	71.1	9.90	251.5	3.23	24	22		21		82.85	2.67	23
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	70.1	54.2	62.1	73	48	65	62	68.0	69.1	6.08	154.4	1.48	18	15		1		102.95	3.32	28
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	69.6	57.9	63.7	73	55	65	60			6.87	174.51	1.44	19	16		2		109.20	3.52	29

Compiled from Returns supplied by the Meteorological Branch, Malaya

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THE

Malayan Agricultural Journal.

MARCH, 1934.

EDITORIAL.

Rubber on Small Holdings

In visualising the future of the rubber planting industry in Malaya, the area planted on small holdings is of very great importance and any information concerning its distribution, yields, and field conditions constitutes most valuable data.

Statistics concerning such areas have improved in recent years, while mainly through the organisation of the Field Branch of the Department of Agriculture, S.S. and F.M.S., our information on the internal economy and the condition of such holdings has accumulated.

There has been a very wide-spread idea that the yields from small rubber holdings are almost bound to decline in future years. The basis for such belief is in the close planting commonly practised; neglect of weeding, drainage and other cultural methods usual on estates; disregard of the diseases which attack the trees; and lastly, wounding of the trees through bad tapping.

Estate practice has, in the past, been at wide variance with the customary methods obtaining on small holdings, but in spite of these differences, which are not so wide as formerly, the yields of rubber from small holdings in Malaya compare favourably with those from large estates.

The questions which concerns us are whether the native producer, in his anxiety to obtain a large crop, is removing bark at too great a rate, so that in future he will find himself without sufficient renewed bark to allow of tapping without resting the trees; whether by deep and careless tapping he is causing premanent injury to the tree; and whether neglect of mouldy rot disease of the tapping panel is so serious as to ruin the trees completely.

The uncertainty which existed concerning these questions led the Rubber Growers' Association in 1930, to approach the Malayan Committee of that body with the suggestion that it was desirable that steps should be taken to inaugurate a series of organised observations of sufficiently wide scope to yield reliable information.

Discussions followed in which the local Committee of the Rubber Growers' Association, the Department of Agriculture and the Rubber Research Institute of Malaya were concerned.

It was eventually agreed that the most effective and efficient manner for performing the work would be to make use of the existing Field Branch of the

Department of Agriculture with additional staff for the taking and compilation of the records and the general supervision of the work.

Discussion with the local Committee of the Rubber Growers' Association resulted early in 1931 in the provision of a grant of $10,000 by the Rubber Research and Propaganda Committee, F.M.S. to enable the work to be undertaken.

Operations were therefore commenced in July of that year when Mr. H. D. Meads was selected to fill the post of recorder in charge of the observations. The actual measurements were completed in the early part of 1933 and the work of computing and collating the large mass of statistics connected with it, by July 1933.

The work has been carried on throughout in close consultation and collaboration with members of the scientific staff of the Rubber Research Institute and in particular with Mr. C. E. T. Mann of that Institute and with the Research, Field and Economics staff of the Department of Agriculture.

In a recently published Special Bulletin of the Department of Agriculture,* Mr. H. D. Meads reports in detail the results of this survey.

Based on the known figures for the State of Johore and on the standard production figures for the last year of restriction (1928), it is probable that of the total area of rubber in Malaya 60 per cent. or 1,879,600 acres is contained on estates of 100 acres and over, 10 per cent. or 313,300 acres on estates of between 25 and 100 acres and the remainder—30 per cent. or 939,800 acres in small holdings of under 25 acres each.

These figures are important because field observations indicate that the quality of the tapping and the consequent bark renewal on estates of between 25—100 acres is equal to that on estates of 100 acres and over. It follows, therefore, that the Report in question concerns 30 per cent. of the total area, or nearly 1,000,000 acres of rubber, in Malaya.

The problems dealt with are two-fold : the rate of bark consumption, and quality of bark renewal.

The investigation shews that the rate of bark consumption on small holdings is nearly 5 inches a year, on the entire circumference of the tree, (4.92 inches is the actual figure).

This allows over 7 years for bark renewal, supposing all tapping not to exceed a height of 6 feet and that tapping is carried out daily throughout this period. It has to be remembered that tapping above this height may be resorted to if circumstances dictate such a course.

Bark renewal depends on the general health of the tree, the quality of the tapping and the incidence of mouldy rot disease.

Systems of planting and cultural methods are not the most important factors in normal bark renewal. On the other hand, bad tapping, causing wounds, results in great irregularity of the surface and is frequently a cause of em-

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* Bark Consumption and Bark Reserves on Small Rubber Holdings in Malaya by H. D. Meads. Special Bulletin, Economic Series No. 4, Department of Agriculture, Kuala Lumpur, S.S. and F.M.S., 44 pages, 8 full page illustrations. Price 50 cents (Straits) post free.

barrassment to the tapper when the time comes to tap on renewed bark. In this event the tapper has two alternatives: *vis,* to open tapping on a new panel above six feet, thus allowing extra time for bark renewal, or to give the tree a resting period. The latter course is frequently followed and is rendered possible by the fact that a large number of trees per acre are planted.

There remains, however, one important potential limiting factor on small holdings—the incidence of mouldy rot disease. If measures are not taken to check the disease the bark is destroyed down to the wood. In this way, therefore, there may be grave danger to the future utility of the tree. In earlier days, when treatment of the disease on small holdings was less general than is now the case, the disease was frequently present for a considerable time without treatment and whole sides of many of the trees were without a vestige of renewed bark. Time, however, is a great healer, and we are informed that native areas which suffered from the disease 14 years ago are still normal producers of rubber.

Mr. Meads comments on the danger of mouldy rot disease. He states that even prolonged neglect of treatment of the disease will not necessarily result in rendering any large area of rubber on small holdings permanently unproductive. He adds that the areas in which treatment is entirely neglected are not believed to be very extensive and are likely to diminish rather than extend, owing to the action recently taken by the Department of Agriculture with the object of rendering easily available to small-holders, supplies of cheap disinfectant which is at least effective in checking the damage occasioned by the disease.

After reviewing the evidence presented by the author, supplemented by our own knowledge of the statistical position and observation over some 20 years in Malaya, we can but agree with the conclusions implied by Mr. Meads; that neither by reason of previous neglect nor present practice can it be expected that the production of rubber from small holdings will decline either in the near future or during the next decade.

Varieties of Tuba.

We are indebted to Mr. M. R. Henderson of the Botanic Gardens Department, Straits Settlements, for a contribution in this number on The Sources of "tuba" in the Malay Peninsula.

Derris, or tuba root, is becoming increasingly widely recognised as an insecticide. Recent work in the Department of Agriculture, S.S. and F.M.S. and by investigators in other parts of the world, has elucidated many of the problems which hitherto have prevented a wider use being made of this product. The data supplied by Mr. Henderson deal with the appearance and characteristics of the varieties of tuba found in Malaya.

In view of the fact that the valuable toxic qualities of tuba vary with the variety, the key supplied by Mr. Henderson will be found of value not only to the investigator but to the planter and exporter.

Chinese Market Gardens.

The operations of Chinese vegetable-growers are a familiar sight throughout Malaya. The care and knowledge expended by these industrious people is evidenced by the flourishing crops of many varieties of vegetables produced in these gardens.

Of late years this form of agriculture has increased in extent until today it plays a not unimportant part in the economy of this country. Particular interest attaches, therefore, to an account in this number on "Chinese Market Gardening" which describes the methods by which these striking results are obtained.

It must be admitted that the Chinese use methods which are not always in conformity with modern ideas on health. At the same time, the first step in overcoming this objection must be a complete understanding of the methods of cultivation at present practised; subsequently we can turn our attention to a consideration of means by which such objections may be overcome without injury to an important phase of agricultural development.

The Chinese system of vegetable growing relies on the inter-dependance of cultivation and pig-breeding—with side-lines as such as fish rearing; any one of these industries might fail alone, but worked together they have proved profitable to the Chinese.

An important point in connexion with this industry is that, in the majority of cases, the gardens are established on old worked-out tin-mining land. The natural fertility of such land is low, but the gardeners are able in a few years to bring this soil to a very high degree of fertility and so to effect a permanent improvement of the land.

Original Articles.

CHINESE MARKET GARDENING

BY

H. J. Simpson,

State Agricultural Officer, Selangor

and

Lau Sing Nam,

Chinese Sub-Inspector of Agriculture, Selangor.

Introduction.

It is a recognised fact that the Chinese are probably the most skilful market gardeners in the world, and that the Western races, in spite of their progress in modern scientific agriculture, can still learn a considerable amount from them.

With this in view, the Department of Agriculture, on the opening of the new Agricultural Station at Cheras near Kuala Lumpur, decided to lay out a portion of the area as a model Chinese market garden. The garden is under the control of the Chinese sub-Inspector of Agriculture, who being trained in western methods of agriculture as well as in his own, has been able to combine the best points of each.

The following notes have been compiled as the result of observations made on the Station and during visits to other Chinese gardens.

Choice of Garden Site.

In the opinion of the Chinese gardeners, the ideal site for a market garden is a piece of flat, rather low-lying land, if possible near to a small stream in order to give facilities for watering and irrigation. Although the land should be low-lying, the soil must be well drained, and hence should contain a fair percentage of sand.

Tools.

The only implement used for cultivation is a digging implement known as a *changkol.* A heavy 5 lb. *changkol* fitted to a handle 5 ft. 6 in. long is used for digging and a lighter 3-4 lb. blade fitted on a 4 ft. 6 in. long handle for weeding. The *changkol* used for weeding has a wider blade than that for digging purposes.

For watering, large wooden tubs fitted with a bamboo or corrugated iron spout are used. Each tub is fitted with two handles through which a rotan is passed, forming a loop some 3 feet high. This serves as a handle for carrying purpose; the usual method of carrying is by means of a *kanda* stick passed through the loops of two such tubs, and supported across the shoulders of the worker.

For applying liquid manures, a small ladle, generally made of galvanised iron and fitted with a handle some 4 to 5 feet long, is used. Each ladle holds about ½ gallon of liquid.

The only other implements that will be seen are baskets of various shapes and sizes which are used for such purposes as collecting the crops and carrying manures.

Coarse organic matter such as *lalang* and other grass is always carried by means of a *kanda* stick and a sling made of bamboo.

Formation of a New Garden.

The land is first cleared by slashing and burning the secondary jungle growth and heavy *lalang* grass (*Imperata arundinacea*). The land is then dug with a *changkol* to a depth of 1 to 2 feet, being left as rough as possible to facilitate the drying out of *lalang* roots. This process is repeated two or three times until practically all *lalang* has been destroyed. A final digging is then given and the *lalang* roots and any tree stumps are removed by hand, collected into heaps and burnt.

Preparation of Beds.

After the land has been cleared, the soil is then formed into a series of ridges or raised beds some 1½ to 2 feet high on which the crops are grown.

The ridges on fairly flat land are straight, but those on hilly land are often V or S shaped, in order to retard soil wash, but in either case, the ridges are equally spaced and parallel.

The ridges after being lightly dug are considered fit for planting.

Preparation of Nursery Beds.

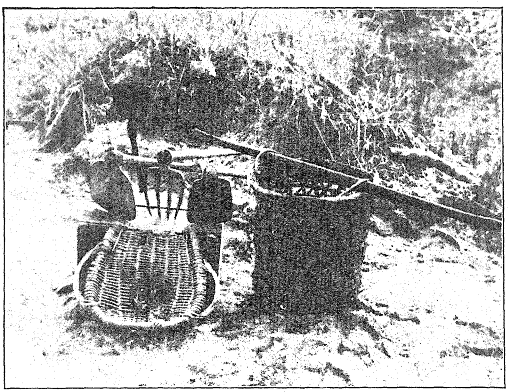
The site of the nursery is always carefully chosen—a rich piece of soil close to an ample water supply being selected. If there is no water supply close to an otherwise suitable portion of land, a pond is generally dug which in many cases is also used as a fish pond. The nursery site is first very carefully dug over—all roots being removed by hand. Manure, generally pig-manure, grass or other organic matter is incorporated into the soil, which is worked up to form a broad flat consolidated bed with a very fine surface tilth.

The average width of a nursery bed is about 4 feet, while the length varies from 20 to 30 feet.

Sowing.

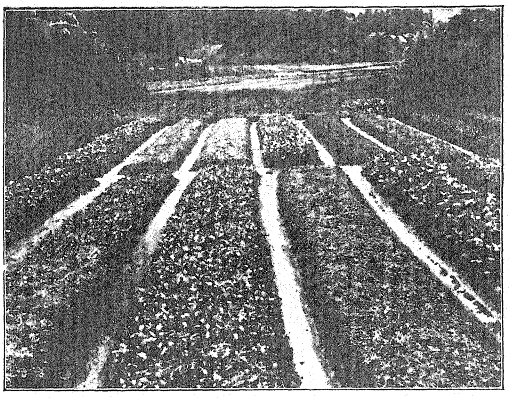
Small seeds, such as chillies and brinjals, are always sown in nurseries, while the larger seeds, such as cucumber and ladies' finger, are sown direct in the field.

Method of making up new beds by splitting old ones down the centre and dragging soil to each side.



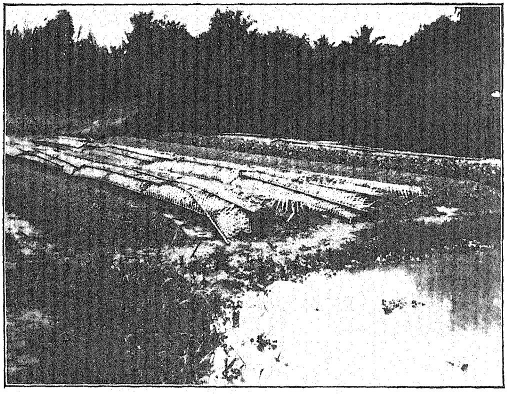
TOOLS USED BY MARKET GARDENERS

Front. Carrying-basket made of split bamboo.
On box. Weeding *changkol,* Fork for digging out *lalang* roots, Digging *changkol.*
Behind box. Small spade for digging drains, wells etc. Large split bamboo basket for carrying grass, with a *kanda* stick passed through handles.



A TYPICAL CHINESE MARKET GARDEN

Note the flat and low-lying nature of the land. The beds, however, have been well raised and cultivated so as to ensure adequate drainage.



NURSERY BEDS

Note proximity of water supply—an artificial pond. The pond was also used for breeding fish.

The seeds are first mixed with wood ashes or earth and then scattered lightly over the prepared nursery beds. The bed is then covered to a depth of 1 inch with *lalang* shoots laid lengthwise along the beds, or by *attap* (dried leaf covering).

This covering of *lalang* or *attap* not only protects the germinating seeds from damage by heavy rain and hot sun, but also assists in retaining moisture in the beds. As soon as the young plants have become well established, the covering is removed and replaced by a temporary shelter made by erecting a light wooden frame some 2½ to 3 feet high over the beds and thatching the roof with *lalang* or *attap*. This shed is removed when the young plants are 4 to 5 inches high.

Sowing in the Field.

The larger varieties of seeds are planted in specially prepared pockets of soil on the top of the already prepared ridges. These pockets are made by scraping out little hollows about 3 inches deep and 6 inches in diameter, and refilling with a mixture of black earth (i.e. soil rich in humus) and manure. The seeds are sown in pairs or threes in the centre of each pocket, and covered to the required depth. One or two rows of plants may be planted on each ridge, according to the variety of plant and the width of ridge.

After sowing, the ridges are shaded with *lalang* shoots, or by placing two or three small leafy twigs around each plant until the seedlings are well established.

Transplanting.

When the young plants grown in the nurseries are sufficiently large to handle, they are transplanted in the prepared ridges. The planting holes are prepared in the same way as those for seeds sown directly in the field.

Careful attention is given to the correct spacing of plants in the field, the plants being not only regularly spaced but also at the optimum intervals. These intervals appear to have been carefully worked out many years ago by a method of trial and error, and the knowledge has been handed down from generation to generation.

After transplanting, the young plants are shaded for about 10 days by small leafy twigs or pieces of *attap*.

Secondary Cultivation.

As soon as the plants have become well established and are big enough to be seen easily, the soil between them is kept well broken up by means of a light *changkol*. This secondary cultivation is looked upon as a most necessary task and is repeated at frequent intervals and carried on as long as possible without damaging the plants.

Manuring.

The most commonly used manures are pig-manure, night soil and prawn sweepings. Although the use of night soil is severely condemned by the Health Authorities, there is little doubt that without its aid a large number of market gardens, especially those established on old mining land, would never have been brought to their present high state of fertility. The use of artificial manures to replace night soil is a very recent introduction and is making but slow headway, chiefly owing to the greater cost of such manures.

Pig-manure, and often night soil, is collected in specially constructed concrete pits connected to the pig styes. The majority of these are partly covered to keep out rain, but few are provided with any means of preventing excess of water used in cleaning the styes from mixing with the manure in the pits.

The usual method of applying pig-manure and night soil to vegetables is as a liquid top-dressing, the manure being first diluted with about eight parts of water. When applying manure to crops grown for pig food, such as sweet potato and vines, accurate dilution is not insisted upon, and in such cases all the water used for bathing the pigs and washing down the styes is run into the manure pits. This, together with a certain amount of rain-water that finds its way in, gives sufficient dilution. This diluted mixture is poured round the plants—by means of a small dipper fitted on a long handle—at intervals of about 7 days throughout the growing period.

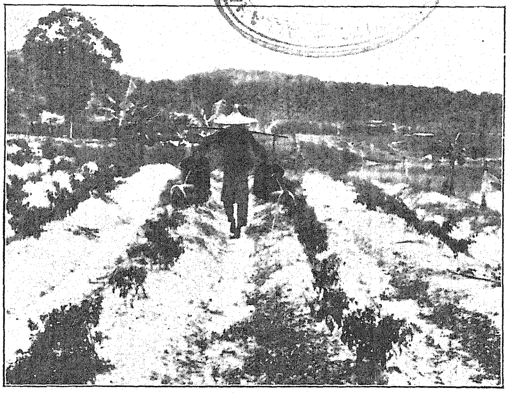
Prawn sweepings are usually applied either in the holes before the crop is planted, or worked in near the rows as an early top-dressing. The usual rate of application is about 8 kati (12 lbs.) to every 32 holes.

Irrigation and Watering.

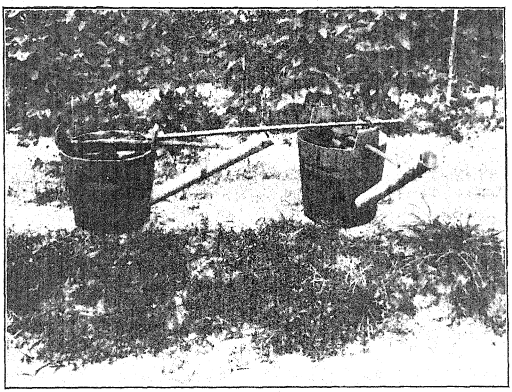
The Chinese market gardener seems to possess an inborn knowledge of irrigation and water requirements of his crops, and probably no other agriculturist can decide so accurately, merely by observation, when and how much to irrigate, and when and how often to water the young plants. There is little doubt that the success of a great number of gardens is largely due to this skill.

During dry weather it is the usual custom, whenever possible, for the gardener to irrigate his beds by damming a nearby stream and allowing the water to flood the hollows between the ridges on which the plants are growing. The irrigation water is allowed to remain on the land for 3 to 4 days by which time the soil is judged to be in the right condition.

In addition to irrigating and where irrigation cannot be carried out, the plants are watered morning and evening during dry weather. This work is extremely laborious and entails carrying vast amounts of water, as the gardeners, realising that it is useless just to sprinkle the soil, always make a point of



Method of watering growing crops using two large converted tubs and '*Kanda*' stick.



Chinese watering cans

THE CHANGKOL SHOWING METHOD OF USING
This is the implement used throughout Malaya for all primary and most of the secondary cultivation.

Method of carrying liquids, using wooden tubs and a *kanda* stick. The small ladle fitted to the end of the stick is used for applying liquid manure.

saturating it. The watering is done by means of large wooden tubs fitted with spouts, each tub holding about 8 gallons of water. This work, in the case of Cantonese gardeners, is generally allotted to women.

Rotation of Crops.

Although no fixed rotation of crops is practised, the same land is never made to carry two successive crops. This is achieved by the simple method, when making up new beds, of dividing the old ones into halves and dragging the soil from half the bed on two adjoining ridges into the hollows between the old beds (as is shown in the accompanying illustration). Thus, the old paths become the centres of the new beds, and the centres of the old ridges new paths. Care is taken while moving the soil from one place to another, not to bring up to the surface raw sub-soil. The new bed so made is never planted with either of the crops previously grown on the two beds from which it was constructed.

Seed Selection.

The Chinese gardener fully realises the importance of sowing good seed. Having first obtained good varieties that grow well on his particular land, he takes great care to preserve the strain, by selecting seeds only from those plants that are above the average. If there are no such plants to be found growing in his garden, he will first try to obtain fresh seed from his neighbours—and if that fails—buy fresh imported seed. Poor, weakly plants are never kept for seed purposes.

Improving the Soil.

If, after one or two crops, the gardener finds that his crops are small and unprofitable, he sows all the poor areas with sweet potatoes followed by yam beans and then by groundnuts, after which he generally finds that he can grow two or three profitable crops. On such lands, large amounts of organic matter, in the form of grass and leaves, are incorporated into the soil in preparing the land for planting. The land once cleared is never allowed to go back into *lalang* and secondary growth as it involves extra labour and expense.

Control of Pests.

Hand-picking and the use of tuba root solution form the chief methods of controlling pests of all kinds. The tuba root solution is made by crushing 4 *tahil* (about 6 ozs.) of tuba root and mixing with 6 gallons of water and is applied by dipping a leafy shoot such as a young bamboo into the mixture and flicking the liquid over the plants. For leaf vegetables, the operation is repeated at intervals of 3 to 4 days throughout the growing season. Ashes are sometimes dusted over the plants as a remedy against moulds and blights. Birds are scared away from seed beds by means of guys—made in exactly the same way as those used in England.

General.

The majority of the Chinese market gardeners in the Federated Malay States are established on old worked-out tin-mining land which is readily drainable and irrigable. The natural fertility of such land is extremely low, and yet it is found that after a few years of working by a Chinese market gardener, a very high degree of fertility is obtained.

The secret for the successful working of such land lies in the abundant use of organic manures, chiefly applied in the liquid form, and frequent deep and thorough cultivation.

Another factor that plays an important part in obtaining good crops from such land is the judicious irrigation and watering of the crops.

THE SOURCES OF "TUBA" IN THE MALAY PENINSULA.

BY

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Two species of *Derris* are commonly cultivated in the Malay Peninsula for *tuba*, 1. *Derris elliptica* and 2. *Derris malaccensis*. The first is a widely spread plant, found from Chittagong through Siam, Cambodia and Malaya to New Guinea and the Bismarck Archipelago. There is some doubt as to whether it is ever found truly wild in the Peninsula.

The second species is a native of the Peninsula and is recorded also from Siam, Tenasserim and Borneo. As grown under cultivation it differs in some important respects from the wild plant, notably in the larger flowers with more hairy calyx and a silky standard, approaching in this respect *Derris elliptica*. For this reason it is proposed to regard it as a variety of *Derris malaccensis* under the name *sarawakensis*. It perhaps would have been better, from a botanical point of view, to have treated it as a species distinct from both *D. malaccensis* and *D. elliptica*, but the name *malaccensis* is now so well known to planters and others in the trade that it would have been confusing to do so. As far as can be ascertained, most, if not all of the stock of *D. malaccensis* now grown here originated in Sarawak or in that neighbourhood. Hence the varietal name, and another name by which it is often known—"Sarawak erect".

As the different kinds of *Derris* differ in their toxic values, it is necessary to have some means of distinguishing them. In the following pages an attempt is made to show how at least the better known and most marked forms or races may be distinguished in the field by leaf characters and habit of growth. An easily-remembered name is attached to each form described.

In the group of true *Derris elliptica*, the variation in leaf-shape is very confusing, even within the same race, and many more races than are given here could be erected on minor differences in leaf-shape, degrees of hairiness and other characters. However, by taking a fairly broad view of what constituted a race, it was found possible to include all the cultivated material seen in the number to be described. After a little practice, these can all be picked out with a fair degree of certainty from a field in which they are growing mixed together.

It must be emphasised that no one leaf from any plant can be relied upon to show all the differentiating points. It is necessary to examine many leaves and to form a general impression of the predominating characters.

The first point to be looked for is the habit of growth of plant. This may be :—

1. Erect, shrub-like, no trailing stems, not forming a cover on the soil.
2. Prostrate, stems trailing on the ground, rooting more or less profusely between nodes and forming a close cover.
3. Prostrate, stems trailing on the ground, habit looser than in 2, stems not rooting profusely, or not at all, not forming a close cover.
4. Prostrate as in 3, but sending up erect or semi-erect woody side shoots.

All *Derris* plants are climbers, and all the prostrate races send up vigorous young shoots which stand semi-erect, but these are to be ignored.

Derris leaves are compound, that is, instead of having a single blade they have many, arranged in pairs along a central stalk, with one terminal one. There is always therefore an odd number of leaflets. That part of the central stalk from the swollen part at the base to the insertion of the lowermost pair of leaflets is called the *petiole* (leaf-stalk) and the rest of the central stalk is the *rachis*. The leaflets are each attached to the rachis by a short stalk called the *petiolule*.

A glance at the drawings will show that the leaves of all the races have a general similarity, but that differences can be observed. The points to look for are :—

1. *Shape of leaflets.* They are usually more or less obovate (inversely ovate, with the broadest part above the middle), but may be ovate (broadest part below the middle), oblong (sides more nearly parallel), or a combination of these shapes. Terminal leaflets tend to be more obovate than the others and the basal one or two pairs tend to be more oblong and reduced in size.

2. *Shape of leaflet tips.* These may be :—

(*a*). A definite rather long narrow point as in fig. 1.

(*b*). A short, quite definite but broad blunt point as in fig. 7.

(*c*). Rounded, or with a very short broad blunt indefinite point as in fig. 8.

3. *Overlapping of leaflets* when a leaf is laid flat.

4. *Degree of hairiness.* All the races dealt with are hairy to some extent, but they vary considerably in the amount present. Very young shoots and leaves are usually densely hairy. In some cases the hairs are not visible to the naked eye, but under a pocket lens, magnifying 8 or 10 times, can always be seen. The hairs tend to drop off as the the leaf becomes old.

5. *Colour of lower surface of leaflet.* All but one of the forms described have a whitish bloom on the under surface of the leaflet. This is quite distinct from any reddish tinge imparted by hairiness.

6. *Number of leaflets.* The number is usually 7 or more. Some races average 7 or 9, rarely more, others 9 or 11 or more, rarely less.

Key to Races Described.

(The number preceding each name is that of the paragraph in which the description of the race will be found).

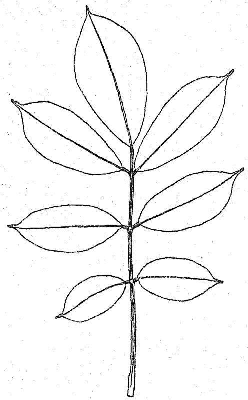

Fig. 1. *Derris malaccensis* var. *sarawakensis.*

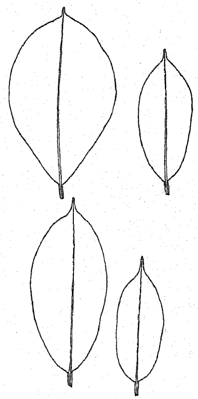

Fig. 2. *Derris malaccensis* var. *sarawakensis.*
Above: Terminal leaflets from same plant.
Below: Side leaflets from same plant.

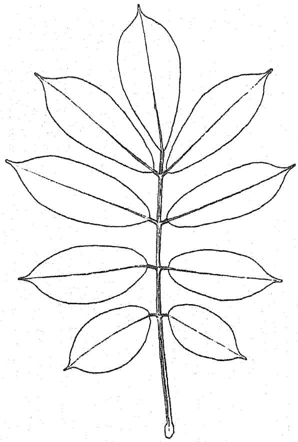

Fig. 3. *Derris elliptica,* Sarawak creeping.

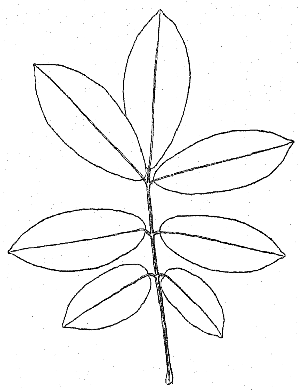

Fig. 4. *Derris elliptica,* Singapore No. 1.

A. Habit erect, shrub-like, leaflets with a definite long narrow point, very sparsely hairy and not white below..................1. *Derris malaccensis* var. *sarawakensis.*

A. Habit prostrate, leaves whitish below :

B. Stems rooting more or less profusely between nodes, forming a close cover, leaflets with a definite long narrow point, very sparsely hairy below..................................2. *Derris elliptica Sarawak creeping.*

B. Stems not rooting profusely, not forming a dense cover, leaflets most usually with a short blunt point or rounded :

C. Leaflets sparsely hairy below, hairs not or hardly visible to the naked eye :

D. Leaflets averaging 7 or 9, not or only slightly overlapping...... ....3a. *Derris elliptica Singapore No. 1.*

D. Leaflets averaging 9 or 11 or more, overlapping................. ....3b. *Derris elliptica Singapore No. 2.*

C. Leaflets much more hairy below, the hairs, at least on the main veins, distinctly visible to the naked eye :

D. Stems with erect or semi-erect woody side shoots, leaflets rather narrow, with a definite short blunt point, rachis usually rather densely hairy.............5. *Derris elliptica Changi No. 2.*

D. Stems without erect or semi-erect woody side shoots :

E. Leaflets rather broad, overlapping, tending to be oblong, with a very indefinite broad blunt point or completely rounded or with a small notch at the apex.................... ....6. *Derris elliptica Changi No. 3.*

E. Leaflets rather narrow, hardly or not overlapping, with a definite broad blunt point..................................... ....4. *Derris elliptica Changi No. 1.*

Preliminary identifications should be made from the key and checked with the descriptions below.

Short Descriptions of Races Mentioned.

1. *Derris malaccensis* var. *sarawakensis.** An erect shrub-like plant, the stems not trailing on the ground or forming a cover. Leaflets 7 or 9, rarely more, rather variable in shape and size, but the side ones usually markedly oblong, the uppermost pair and terminal one usually definitely obovate, tips of leaflets with a definite, prolonged narrow point. Upper surface of leaflets more or less shining, with a few scattered white hairs, visible under a lens, older leaflets often without hairs above; lower surface paler green than upper surface, surface, without white bloom, always with some reddish hair which is more pronounced on the veins and reticulations than on the intervening spaces. Both surfaces appear to the naked eye to be without hair, but a lens will always show

* *Derris malaccensis,* Prain, var. *sarawakensis,* Hend., var. nov. A typo floribus maioribus, vexillo pubescente differt.

some hair on the lower surface. Petiole, rachis and petiolules usually with sparse whitish hairs, or the petiole without hairs, petiolules sometimes brownish, usually green.

Distinguished at a glance from other kinds by its erect shrubby habit, the pointed leaflets without white bloom beneath, and sparseness of hair.

Widely known under the names "tuba rabut" and "Sarawak erect". It has also been wrongly called *Derris chinensis* and *Derris uliginosa*. Figs. 1 and 2.

2. *Derris elliptica Sarawak creeping.* Plant prostrate, forming a close cover, with the stems often rooting profusely between nodes. Leaflets usually 7 or 9, not overlapping when leaf is laid flat, or the terminal one and the uppermost pair overlapping slightly, shape similar to that of *D. malaccensis* var. *sarawakensis,* usually obovate or obovate-oblong, the basal pairs broader, the bases of upper leaflets narrowed and hardly rounded, those of lower leaflets broader and more rounded; tips usually with a definite prolonged narrow point. Upper surface of leaflets shining, without hair or with very sparse whitish hairs visible under a lens; lower surface with whitish bloom and a sparse covering of pale reddish hairs visible only under a lens. Petiole, rachis and petiolules very sparsely whitish or pale red hairy, or sometimes practically without hair, the backs of petiole and rachis without hair. Very young leaves comparatively sparsely reddish hairy.

In leaf shape very similar to *D. malaccensis* var. *sarawakensis*, but the prostrate habit at once distinguishes it. From the forms described below it is distinguishable by its pointed leaflets, dense habit and very sparse hairiness. Fig. 3.

3. *Derris elliptica Singapore No. 1.* Plant prostrate, stems trailing but not forming a dense cover. Leaflets 7 or 9 or more, very variable in size and rather variable in shape, but usually obovate or obovate oblong, the lower one or two pairs reduced in size and broader in proportion than the others; tips usually with a definite short blunt point, the apex of which often has a minute but distinct notch; bases narrowed then rounded, the lowermost pairs often not narrowed. Upper surface of leaflets rather dull, with sparse whitish hairs hardly or not visible to the naked eye; lower surface with a distinct white bloom except on the veins, and with a sparse covering of reddish hairs on the veins and reticulations, hardly visible to the naked eye except as a reddish tinge on the main nerves. Petiole, rachis and petiolules with sparse whitish or pale red hairs, the petiole soon losing them, the back of the rachis without hair.

Distinguished from *Sarawak creeping* by the looser habit, the blunter leaflet tips and the slightly more pronounced hairiness, and from the following forms by the definitely less hairy leaflets and rachis. Figs. 4, 5, 6.

Not many plants have been seen of this race, but they seem sufficiently distinct from the others. Even in the few plants seen it was possible to subdivide the race into

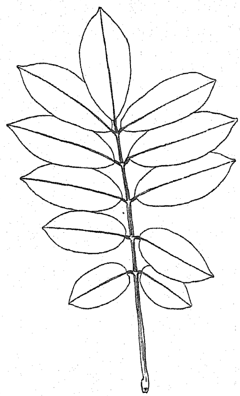

Fig. 5. *Derris elliptica*, Singapore No. 2.

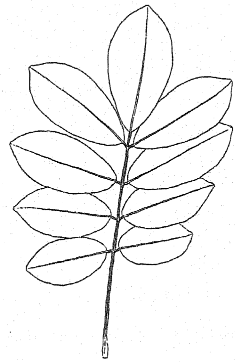

Fig. 6. *Derris elliptica*, Singapore No. 2.

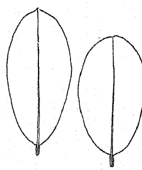

Fig. 9. *Derris elliptica*, Changi No. 3.
Side leaflets.

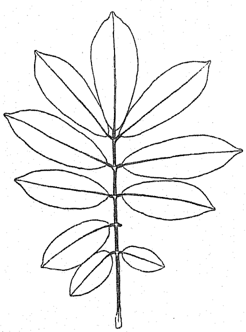

Fig. 7. *Derris elliptica*, Changi No. 1.

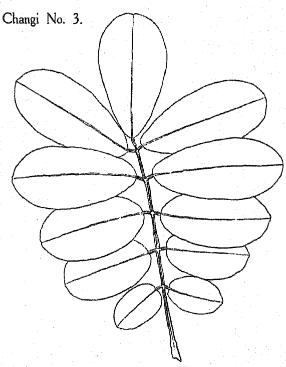

Fig. 8. *Derris elliptica*, Changi No. 3.

a. Plants with leaflets averaging 7 or 9 only, the leaflets rather distant, not or only slightly overlapping when laid flat. Fig. 4.

b. Plants with leaflets averaging 9 or more, overlapping. Figs. 5 and 6.

No other essential difference could be detected between these two sub-forms, but if it is considered advisable to keep them apart, *a* (with 7 or 9 leaflets) may be called *Derris elliptica Singapore No. 1*, and *b* (with 9 or more leaflets) *D. elliptica Singapore No. 2.*

4. *Derris elliptica Changi No. 1.* Plant prostrate with long trailing stems, not forming a close cover or rooting profusely, and without erect woody side shoots, although the young shoots are often erect. Leaflets 9 or 11 or more, rarely less than 9, rather narrowly obovate, the basal leaflets broader and more oblong, often reduced in size, the upper leaflets very definitely narrowed to a rounded base; leaflet tips with a definite short blunt point, the apex often minutely notched. Leaflets not or only slightly overlapping, texture rather thick, upper surface dull, always with some scattered white hairs especially along the veins, hardly visible to the naked eye; lower surface with whitish bloom, rather densely hairy, particularly on the veins, the hairiness easily visible to the naked eye, though it tends to become sparser in older leaves. Young shoots and leaves densely red hairy. Petioles, rachis and petiolules rather densely to sparsely whitish or pale red hairy, the back of the rachis usually with some hair.

Distinguishable from *Sarawak creeping* by its looser habit, bluntly pointed leaflets and increased hairiness, from *Singapore Nos. 1 and 2* by its narrower and somewhat thicker leaflets and increased hairiness and by its slightly longer leaflet tips.

This is the form most generally cultivated in Singapore. The Chinese name *Ney Kee* is given for it. Fig. 7.

5. *Derris elliptica Changi No. 2.* This form is very close to *Changi No. 1* and very difficult to separate from it on leaf characters alone. The same description would fit leaves of both, except that those of *Changi No. 2* tend to be slightly broader towards the base of the leaflets, the leaflet tip is slightly shorter and broader, and the hairiness appears to be always somewhat more pronounced, with the petiole and rachis definitely more hairy, the hairs persisting longer on the backs of both. The chief difference is in the habit of growth. *Changi No. 2* has erect woody side shoots, and in a field where *Changi No. 1 and Changi No. 2* are growing together, the latter can be picked out with some degree of certainty by this character alone.

Changi No. 2 is disinguishable from *Singapore Nos. 1* and *2* by the narrower, somewhat thicker, and much more hairy leaflets.

The Chinese name *Lui Ting* is given for this form.

6. *Derris elliptica Changi No. 3.* Plant prostrate, stems trailing but not forming a dense cover, and without erect woody side shoots. Leaflets 9 or more, rarely less, usually distinctly overlapping, obovate to obovate oblong, the bases

only slightly narrowed and then rounded; leaflet tips very blunt, sometimes with a very short broad blunt point often notched at its apex, or rounded with no point and notched, or rounded and not notched. Upper surface dull, usually with a few scattered white hairs, especially on the veins, visible under a lens, often without hairs; lower surface with a dull, rather dirty white bloom, reddish hairy especially on the veins, hairiness visible to the naked eye. Petioles, rachis and petiolules sparsely to very sparsely reddish or dirty white hairy, in the older leaves losing most of their hair, in younger but fully developed leaves the backs of the petioles and rachis sparsely hairy.

Distinguished from *Singapore Nos. 1* and *2* by the somewhat thicker, usually smaller leaflets with distinctly more hair below, and by the blunter leaflet tips, and from *Changi Nos. 1* and *2* by the broader leaflets not so markedly narrowed to the base, the much blunter leaflet tips and the sparser covering of hair.

The Chinese name *Low Ting* is given for this form. Figs. 8 and 9.

American botanists have adopted an older name—*Deguelia*—for *Derris*, which may cause some confusion. However, according to the code of rules of nomenclature followed by most British and Continental botanists, *Derris* is the correct name to use.

I am indebted to Mr. J. N. Milsum, Central Experiment Station, Serdang and to Mr. G. P. D. Olds, Agricultural Officer, Singapore, for much help and advice; and to Messrs. Cooper McDougall & Robertson, Ltd., Bentong, the Senai Rubber Estate Co., Ltd., and Mr. George D. Mackay, Singapore, for specimens and information. I have also to thank the Director, Royal Botanic Gardens, Kew for identifying certain specimens; the Director, Algemeen Proefstation voor den Landbouw, Java, for a set of specimens, and the Curator, Sarawak Museum, for the loan of material from Borneo.

THE AVOCADO PEAR

BY

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The Avocado Pear is a comparatively recent introduction to horticulture although it has been cultivated in Mexico and Central America from very early times. In these countries the fruit is cultivated around dwellings, no large plantations exist and very little care has been taken with its cultivation (1). During the last thirty years or so, horticulturists in California and Florida have devoted attention to its cultivation and the vegetative propagation of superior varieties. In these two States the cultivation of the Avocado has become of commercial importance. It is also cultivated largely in the West Indies and Hawaii.

The commercial aspect of Avocado culture has been especially emphasised since 1910 (2) when explorers from the United States of America were sent to Mexico and Guatemala to obtain the best varieties cultivated in those regions. The California Avocado Association, which was organised in 1915, has influenced the development of the industry (2) and its committee has rendered valuable service by the registration and classification of varieties. The Year Book of this Association for 1931 contains a list of 400 varieties including names of Avocados published in the West Indies and Hawaii (3).

A co-operative marketing agency, founded by the Calavo Growers of California, in 1924, assists with the marketing of the fruit, and a similar organisation exists in Hawaii, shipping the fruits to American markets (7).

The Avocado is now cultivated in most tropical and sub-tropical countries although it has not yet become as popular elsewhere as it is in America.

The date of the introduction of the Avocado into Malaya is uncertain, but Ridley (4) mentions that trees were fruiting in Singapore in 1902. The Avocado was also being cultivated at the Government Experimental Plantation, Kuala Lumpur in 1908 (5). A few of these trees fruited in 1913 and, early in 1914, the present writer (6) advocated extending the cultivation of the fruit. Since that date the Avocado has been grown on a small scale in different parts of the Peninsula and has fruited well both in the plains and at the "Gap" 2,800 feet above sea-level. During the last decade, seedlings have been distributed by the Department of Agriculture; in spite of this fact, the fruit is not as widely known, even among Europeans, as it deserves to be. This is probably due to the fact that a taste for the fruit has to be acquired, in consequence of which it is rarely seen in the local markets.

Botanical.

The Avocado Pear belongs to the Natural Order *Lauraceae* and is therefore related to the Cinnamon. The varieties under cultivation are of two species, viz. *Persea gratissima,* Guertn (syn. *P. americana,* Mill.) and *P. drymifolia,* Cham. and Schlecht (syn. *P. americana* var. *drymifolia,* Mez.) The former species include the West Indian and Guatemalan types or races and the latter the Mexican types (1).

It is a tree of medium size, attaining a height of 20 to 30 feet under cultivation, but in Central America it is recorded that old trees reach a height of 60 feet (1).

The tree may be either erect, compact, or spreading in habit. The bark of the trunk and older parts of the branches are grey in colour while the tips are smooth and green. The leaves are alternate, crowded near the ends of the branches and vary in shape from lanceolate to ovate or even obovate with blunt to acuminate tips. The blades of the leaves vary from 3 to 4 inches to as much as a foot in length, light to dark green in colour, smooth and shining above and glaucous beneath. The flowers are small, yellowish-green in colour, complete with both stamens and pistils, and they are borne in racemes near the ends of the branches.

Stouts (9 and 15) investigations on the Avocado have enabled him to classify varieties into two groups (1) those (Group A) in which the flowers function as pistilates or females in the forenoon and staminates in the afternoon and (2) those (Group B) which function as males in the forenoon and females in the afternoon. The flowers open synchronously in sets and there are normally two periods of opening. In Group A the first period of opening takes place in the forenoon when the stigmas are receptive. These flowers close at about midday and open again for the shedding of pollen in the afternoon of the following day. In Group B the flowers open for the first or female phase in the afternoon, close in the evening, opening again for shedding pollen on the following morning or on the morning of the third day. There is a certain amount of overlapping as regards opening and closing of flowers, especially under unfavourable weather conditions when the first and second openings of the flowers are often delayed. Some varieties have been found to produce excellent crops of fruits in the absence of trees of another group, but despite these observed instances in which trees are not dependent upon cross-pollination, Stout considers that interplanting of reciprocating varieties is normally advisable to ensure that proper pollination takes place which is essential to the production of fruit.

Varieties.

The varieties of both species of Avocado are closely alike in many respects; the differences between the different races are briefly as follows (1) :—

1. Leaves anise-scented, skin of fruit thin and membranous (rarely more than 1/32 inch thick)—*Persea drymifolia.* The Mexican race.

2. Leaves not anise-scented, skin of fruit thicker (from 1/32 to 1/4 inch in thickness)—*Persea gratissima*:

(*a*) Fruit ripe in summer, skin usually not more than 1/16 inch thick, leathery in texture—West Indian Race.

(*b*) Fruit ripening in winter and spring, skin 1/16 to 1/4 inch thick, woody in texture—Guatemalan Race.

The Mexican race is a native of the Mexican highlands and will therefore withstand cold conditions.

The West Indian race has been developed in the tropical lowlands of Guatmala, while the Guatemalan race is a product of the highlands, but there are intermediate forms.

Other distinguishing characters are that the flower of *P. drymifolia* is more pubescent and the underside of the leaf more glabrous than that of *P. gratissima*. The fruits of both species vary in size, but those of *P. drymifolia* are usually smaller than those of *P. gratissima*. They vary in size from a few ounces to three pounds; in shape from round to oval and pear-shaped, and in colour from green to purplish-black. The fruit is a drupe having a single large seed, often 2 inches in diameter, in the centre. The edible portion of the fruit is between the skin and the seed, and when ripe is of the consistency of butter, cream-coloured to green near the skin, of a nutty flavour and contains a large percentage of fat.

The varieties cultivated in Malaya vary considerably in size, shape, and also colour of the fruit, but the majority belong to the West Indian race. The Mexican type is little known, but a few seedling trees are growing at the Central Experiment Station, Serdang, although they have not yet fruited. In Malaya, the West Indian varieties are suitable for cultivation from sea-level up to an elevation of about 3,000 feet. The Guatemalan varieties are said to withstand both cold and heat, also a dry climate, while the Mexican varieties are said to withstand a few degrees of frost. These two races may thrive at higher elevations in this country.

In selecting varieties for cultivation, preference should be given to those with fruits of medium size, say 12 to 16 ounces. The fruit should be of good flavour, the skin tough, leathery and of moderate thickness, so that they will withstand transport for some distance. The seeds should be small and not loose in the cavity otherwise the flesh may be injured in transit.

Propagation.

Propagation locally has been by seed, but the disadvantage of this method is that the offspring cannot be relied upon to come true to the parent type; the Avocado is therefore usually propagated by budding or grafting.

Attempts have been made to propagate the Avocado by marcottage but so far without success, although it is reported that, after numerous failures, well-rooted plants have been obtained by this method in the Philippines (10).

By planting seedlings in beds and laying them down for propagation by the etiolated shoot method, rooted shoots have been obtained, but so far the difficulty in obtaining authentic planting material has made this method impracticable. A stock of budded material is, however, being raised by this Department and will be available in the rear future, when budded plants of known origin have been established by the eteolation method may prove useful for rapidly increasing supplies of reliable planting material.

The most common method of propagation is by budding and grafting, and the best stocks to use for this purpose in Malaya are seedlings of our local varieties. In California, the Guatemalan race has been budded on to stocks of the Mexican race with the object of giving hardiness to the former, but in the even climate of the plains of Malaya hardiness is a point of little if any importance.

Raising Stocks.—The seeds should be planted as soon as possible after removal from the fruit. They should be planted pointed end upwards in loose sandy soil, in boxes or seed beds and after germination the seedlings should be transplanted into large bamboo pots or into nursery beds at about 18 inches apart. Germination takes place in a short time and seedlings are ready to bud in six to eight months, when the stems will be about one half inch in diameter. It is essential that seedlings to be used as stocks should be maintained in vigorous growth.

Budding Methods.—Several methods of budding Avocados are recommended and have been successful in other countries. It should be borne in mind, however, that skill and patience are required, and above all a very sharp budding knife. For the benefit of those who do not understand the various methods of budding, they are described briefly as follows :—

The "inverted T" method is performed by making a "⊥" shaped incision in the bark of the stock an inch or two from the ground with the blade of a sharp knife. Budwood is then procured from a shoot of recent growth not soft enough to snap when bent but beginning to mature. The buds should be plump but not bursting into growth. The knife should then be inserted about an inch below the bud and drawn upwards and inwards beneath the bud, bringing it out about the same distance above the bud. A shield-shaped piece of bark with a section of wood attached is then obtained. The section of wood should be carefully removed and the bud attached to the piece of bark inserted into the incision in the stock. The bud is then bound firmly in place with raffia or a thin strip of waxed cloth, taking care not to cover the bud completely. In about three weeks from the time of budding the tying material should be removed and if, on examination, the bud is found to be green it should be retied but not tightly, and at the same time the apex of the stock should be pinched out. The bud should be examined again at the end of six weeks and if it is still alive the wrapping may be removed. At the same time the stock may be cut back still further, but some leaves should be left. The stock should not

be cut back completely until the bud shoot is about 2 feet in length. When cutting back the stock, a neat cut should be made close to the union between bud-shoot and scion and the wound should be covered with some protective material such as grafting wax.

Other methods of budding recommended differ only in the shape of the incision in the stock. The Forkert method, a modified form of rectangular patch budding, has been used successfully in Java (12) with buds from non-petioled ripe budwood. The method consists in making three incisions in the stock, two parallel downwards and one across the top, forming three sides of a rectangle. The bark is then raised carefully, gripped between the blade of the knife and the thumb and stripped downwards. Three quarters of the flap of bark is then cut away. A piece of bark of the same size and shape as the incision in the stock containing a bud is then inserted and tied into place. The subsequent procedure is the same as for the inverted "T" method.

Grafting.—In Florida (1) the Avocado has been propagated by grafting the tips of young shoots on to the shoots of young seedlings by a modified method of side-grafting. The operation is performed as follows:—The seeds are germinated in boxes and, when the young shoots are 5 to 6 inches in length, the seedlings are taken from the box and laid on a bench. A cut one inch long is made in the side of the shoot just above the seed and a thin section is removed. The scion is taken from the tip of a small branchlet not fully mature and about one inch long with two axilary buds in addition to the terminal one. The scion is then tapered on one side to fit the cut on the stock and is bound into place. The plant is afterwards potted, placed under partial shade and carefully watered from day to day. After union is effected the top of the seedling is removed and the scion allowed to grow.

Cleft Grafting.—Cleft grafting is used on young stocks and in top working older trees. For grafting on to young stocks the scion should be a partially mature shoot, greenish to light brown in colour and about 4 to 5 inches long. This should be tapered at the lower end and inserted in a cleft in the top of a stock of the same colour and size as the scion (10).

Top Grafting.—This method is used in cases where a tree has proved to be unfruitful or is of an inferior variety. The trunk is cut back with a saw to within three feet of the ground. The trunk is then split, a saw being used to cut down for several inches when a soft wood wedge is inserted and driven in until the trunk commences to split; the edges of the cleft are then smoothed with a knife. Scions of mature growth are then cut and tapered to fit the cleft, one on each side of the trunk, so that the cambiums of both stock and scion are in contact. The wedge is then lifted sufficiently to allow enough pressure from the cleft in the stock to hold the scion in place, after which the wedge is cut off flush with the top of the stock. The cleft and sides of the stock are then covered with grafting wax to prevent the entrance of water. To prevent sun-scorch the top of the stock end the scion is covered with a tough

paper bag, holes being made to allow new growth from the scion to elongate. Another method is to place a paper collar round the top of the stock and fill it with sand, holes being made in the base to allow drainage of rain water. The sand should be placed round the outside of the scion as well as at the top of the stock. These paper coverings should not be removed until the scion is large enough to provide shade. A certain number of shoots from the stock may be allowed to grow to maintain circulation of sap which assists healing. They should be eliminated as soon as the scion and stock have properly united.

Another method of top working old trees is to cut back a certain number of branches leaving one or two as "lungs" to maintain the circulation of sap. The young shoots, which sprout from the cut branches, should be limited to two or three; when large enough, they are budded in the same manner as seedling stocks.

Soils and Cultivation.

Soils.—The Avocado is said to thrive on a wide range of soils in South America. It grows excellently on both sandy soils in Florida and heavy clays in California, but it is essential that the soils should be well drained. In Malaya it has been grown successfully on both quartzite hill and quartzite valley soils, also in the granite soils of the hills.

Planting.—The distance at which to plant will depend upon whether the soil is particularly fertile or rather poor, also on whether the tree is a seedling or has been propagated vegetatively by budding or grafting. Planting distances recommended are 20 ft. x 20 ft. which allows 108 trees per acre to 26 ft. x 26 ft. or 64 trees per acre. On light sandy soils or with budded plants 20 ft. x 20 ft. is usually sufficient, but seedlings on rich soil may be given the wider spacing.

When planting it is advisable to make large holes, and these should be filled with good top soil and cattle manure or garden refuse. Usually holes 2 ft. x 2 ft. x 2 ft. should be dug and when filling them the soil should be made quite firm.

The Avocado is rather sensitive to disturbance of the roots; plants should therefore be raised in bamboo pots, so that they can be transplanted with the roots intact. If raised in nursery beds the plants should be prepared for transplanting by balling a week or two before this operation takes place. Should the roots be at all disturbed the foliage should be reduced or evaporation will be too rapid and the plants will receive a severe check.

The best time to plant is during the rainy seasons of the year; even at this time a good watering should be given to settle the soil round the roots and the plants shaded until they are established.

After-cultivation consists in keeping the soil round the plants free from weeds and, as the trees develop, the area weeded should be extended. A mulch of weeds and cattle manure is beneficial to the growth of the plant. The Avocado requires good cultivation and manuring to give the best results. Cattle manure, if obtainable, is best for general purposes. The growing of leguminous

green crops and turning them into the soil periodically will help considerably towards keeping the soil fertile. In addition, fertilizers are recommended (1) in the form of bone meal, and cotton seed or groundnut cake at the rate of 4 or 5 lbs. per tree added to the soil after the trees have borne fruit, and again after the fruit is set. Little is known about the manuring of the Avocado in Malaya, but in addition to cattle manure a mixture of basic slag, calcium cyanamide and sulphate of potash in the proportion by weight of 3 : 1 : 1 : may be applied twice a year round the trees at the rate of from 1 to 4 lbs. per tree according to age. If the trees appear to be growing vigorously, the calcium cyanamide may be omitted.

Pruning.—Very little pruning is necessary beyond that which is essential to keep the tree in shape, and the cutting out of dead or diseased branches.

Pest and Diseases.

In Malaya the Avocado Pear has so far been remarkably free from pests and diseases. In America, thrips, *Heliothrips rubrocinctus* and *H. haemarrhoidalis* have caused damage to the foliage, but spraying with nicotine solution has been an effective control. The red spider, *Tetranychus mytilaspidis* has also done damage but lime sulphur mixture has been used successfully in combatting this pest. Attacks by scale insects are also reported from America.

A root disease, *Sphaerostilbi repens*, has caused the death of several trees at the Central Experiment Station, Serdang, and a certain amount of die-back of branches has been noticed.

The Crop.

The Avocado tree, when raised from seed, commences to bear fruit in about the fifth or sixth year from planting, but budded trees are reported to bear fruit much earlier, in some cases, three years after planting. Seedlings planted at the Central Experiment Station, Serdang, in October, 1927 fruited in August and September, 1932. Others planted in April, 1928 fruited in August and September, 1933, while one tree planted in September, 1929 fruited in September, 1933.

Mature trees will bear from a few fruits up to several hundred. Large trees, in their country of origin, are said to bear from 1,000 to 3,000 fruits from 6 to 18 ounces each in weight. Trees bearing larger fruits bear less, the average, however, is said to be 200 to 300 fruits of 12 to 14 ounces each in weight.

Seedling trees vary considerably in their capacity for bearing fruit, they are also said to be irregular in bearing, for a tree bearing a good crop one year may not fruit the next. This is the case at the Central Experiment Station, Serdang, where only about 50 per cent. of the trees have borne fruit in 1933 and of these about half have borne an average crop, others a few fruits only. The fruits from different trees varied in size from 3 to 4 ounces up to 14 or 16 ounces; in colour from green to purple; the skins of the fruits of some trees

were quite smooth while others were rough. None of the trees bore very large fruits compared with varieties under cultivation in the countries of origin, California and Florida, where it is reported that varieties bear fruits up to 3 lbs. in weight.

The Avocado Pear at Serdang commences to flower about the middle of January and the fruits ripen in August and September. There is some difficulty in judging when some varieties are ripe, especially those with green skins. With the purple varieties there is not so much difficulty, for the fruits are green until they commence to ripen, when the colour gradually changes to a purple tinge. The fruits should be picked before they commence to soften, more especially if they are to be transported some distance to a market. Fruits picked when too under-ripe may shrivel slightly, but if picked when nearing maturity they may be stored until they soften.

Methods of Preparation for Food.

In its country of origin (8) the Avocado Pear forms an important article of diet to the population who use it daily throughout more than half the year. An Avocado and a few small corn cakes made from coarsely ground maize is considered, by the Indians of Guatemala, to constitute a good meal. The fruit is broken in half and the pulp, sprinkled with salt, is scooped out of the skin either with the fingers or a piece of corn cake. Among the Guatemalans of European blood, the pulp of the Avocado is usually added to meat soups at the time of serving and the flavour imparted is said to be exceedingly pleasant. Another usual practice is to serve a salad composed of thoroughly mashed Avocado pulp, vinegar, salt, pepper and finely chopped onions. This is said to be a popular and very tasty dish though not especially attractive in appearance.

In the United States of America, where the fruit is increasing in popularity, the pulp is used as a salad either alone or mixed with lettuce leaves, onions or other vegetables. Sliced or mashed it can be made into sandwiches with bread or cracker biscuits. It is excellent as a salad, either with cold meat or with bread and butter, when mashed and mixed with pepper, salt, and vinegar. Mashed with onions and lime juice it constitutes a favourite dish in Cuba. In Brazil it is looked upon more as a dessert fruit and is also made into ice-cream. The pulp of the fruit, mixed with a little sugar and sherry, has a pleasant nutty flavour and in this way can be used as a dessert.

Food Value.

The flesh of the Avocado is a nourishing article of food containing a high percentage of mineral matter, protein and fat. Its chief value as a food is its high fat content, the digestibility of which has been found by experiment to be equal to that of butter fat or of beef fat.

The calorific energy producing value of 28 varieties of Avocado examined at the University of California represents 1,000 calories for one pound of flesh. The maximum and minimum were 1,325 and 597 respectively. The maximum corresponds to 75 per cent. of the calorific value of cereals and is nearly twice that of lean meat.

The following table from Popeno's Manual of Tropical and Sub-Tropical Fruits represents the work of Jaffa of the University of California on the food value of the Avocado :—

Variety.	Water. per cent.	Protein. per cent.	Fat. per cent.	Carbo-hydrates. per cent.	Ash. per cent.
Trap (West Indian) ...	78.66	1.61	9.80	9.08	0.85
Sharpless (Guatemalan) ...	71.21	1.70	20.54	5.43	1.12
Puebla (Mexican) ...	63.32	1.80	26.68	6.64	1.56
Fuerte (Hybrid) ...	69.86	1.25	29.14	7.40	1.35

Recent investigations by Le Roy Weatherley and Eugene W. Waterman of the University of California (14) using Albino rats as indicators, has demonstrated the presence of Vitamin "B" in the flesh of the fruit. The flesh or pulp was compared with Flesschmanns dry yeast standard and was found to have approximately one-twelfth the value of dried yeast. The authors comment as follows :—"From these investigations it is apparent that the Avocado ranks high as a source of Vitamin "B". If what is known as Vitamin "B" is in reality two vitamin factors one antineuritic and one growth promoting, as recent investigations seem to indicate, it is evident that the Avocado contains both factors since it prevents paralytic symptoms".

Summary.

1. The distribution, botanical, and distinguishing features of the different races of Avocado are discussed.

2. The different methods of propagation of the Avocado are given together with notes on its cultivation.

3. The methods of preparation, food value, and vitamin value of the Avocado are given.

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Miscellaneous Article.

Growth of the Soya bean Industry in America and its Effect on the Malayan Copra and Palm Oil Trade.

The United States of America have in past imported substantial quantities of copra and palm oil from Malaya and other tropical countries and despite the prevailing depression, exports of this produce from Malaya to the United States have been maintained even though there has been a marked decrease in the export in the year 1932 as the following figures show :—

		1930	1931	1932	1933
		tons	tons	tons	tons
Copra	...	27,579	23,350	10,579	17,618
Palm oil	...	772	1,267	925	2,991

It has, from time to time, been suggested in the United States of America that the importation of these products competes with local dairy produce and recently there has been a further revival of this contention in a more acute degree.

Foreign oils and fats, other than coconut oil, in 1932 constituted only 56-100 of 1 per cent. of the foreign oil ingredients of oleomargarine in the United States of America, while only 5½ per cent. of the edible oil and fat consumption of that country in 1932 was of foreign origin and most of this was used in the baking and confectionery trades. Practically all the imported oils and fats are the necessary raw materials of industries which are producing manufactured products of a non-edible nature, such as paint, varnish, soap, linoleum, tin-plate, and tanners of oils.

The above are the industries in the United States which absorb the bulk of the imports from Malaya of the products from the coconut palm and the oil palm. It is evident that there is not at present any real grounds for a conflict of interests with dairymen.

In the post-war period, the United States of America has been the largest single consumer of coconut oil, absorbing about one-third of the world's supplies, and the restriction of imports of copra and palm oil into the United States would undoubtedly have a marked effect on these industries in the producing countries.

The demand for coconut oil depends largely on the expansion of the soap industry and on the competition of other vegetable oils and fats and animal and marine fats used in this industry. The same applied, in a large measure, to palm oil, although in this case, it is believed that it is finding increasing favour in the United States for edible purposes.

In the *Malayan Agricultural Journal* published in March, 1933, the questions of the substitution of other oils for coconut oil and palm oil is discussed in abstracts from a report by (1) The Empire Marketing Board and (2) The United States Tariff Report on Certain Oils.

These reports, however, do not include figures relating to the growth of the soya bean industry in the United States which have recently been published in *The Journal of Chemical Education*, Vol. I, No. 10 (January 1933).

It appears from this article that the area under soya beans in the United States has increased from 50,000 acres in 1917 to 3,497,000 acres in 1931, and that this crop, which was formerly grown as a forage crop, is now grown to a large extent for crushing purposes. The quantities of beans crushed in recent years have been as follows:—

1925—26	—	10,520 tons.
1926—27	—	10,036 ,,
1927—28	—	16,728 ,,
1928—29	—	26,448 ,,
1929—30	—	48,038 ,,
1930—31	—	121,455 ,,

If the importation of copra and oil palm products into the United States is restricted in order to encourage home production of oil-producing crops, it is not improbable that the demand for coconut and oil palm products in the United States will in the future tend to diminish.

Abstract.

AGRICULTURE IN THE PHILIPPINE ISLANDS.*

The Governor-General, Theodore Roosevelt, arrived in the Philippines on 29th February, 1932, when it was found that the Government expenditure for 1931 had exceeded the revenues by 7,200,000 pesos. He, therefore, set out to familiarise himself with the country and its problems by personal inspections and contact with the leading citizens. As a result of his energetic investigations, he concluded that immediate action must be directed towards a balanced budget, a re-organisation of the Government on lines of greater economy and efficiency and a revision of its revenue system. He realised, at the same time, that positive action must be taken to develop and foster industries in order to lay a broader base for prosperity in the future. He recognised that particular attention must be devoted to the welfare of the small-holder who was most seriously affected by the crisis as the Philippines are primarily dependent on agriculture, the basic products on which the wealth of the country depends being copra, rice, tobacco, hemp and sugar. Since 1929 the prices of all these products had depreciated very heavily.

By March, 1932, it became apparent that 1932 revenue would fall short of the estimates by over 17 million pesos; consequently, the Governor-General laid the situation before his councillors and immediate steps were taken to effect economies estimated at over 6 million pesos or approximately 20 per cent. reduction in the latter six months of the year. Resulting from the adoption of these economies, coupled with an unexpected gain in customs revenues due to heavy imports in anticipation of increases in tariff rates, the year 1932 ended with a surplus balance. In addition to the executive action described above, legislative action was taken to eliminate duplication of duties as far as possible.

For the purpose of balancing the budget in 1933, a further reduction of 24 per cent. was made in the operating cost of the governmental machinery, thus reducing the estimates to a total of 42,000,000 pesos.

In addition to this heavy reduction, the Governor-General was empowered to reduce all or any part of a budget by 10 per cent. should it be found necessary in order to ensure that expenditure did not exceed income and it was enacted that no new public works should be initiated without the approval of the Governor-General. It is worthy of note that in effecting economies and in providing for the continuation of the machinery of the government, no serious consideration was given to any suggestion that deficits should be met by borrowing, but that necessary steps were courageously taken with a clear sight of the basic needs of the situation.

The land tax, which forms the main source of support of the provincial governments, became an intolerable burden to the landowners consequent upon the material depreciation in the values of produce, so that a large percentage of

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this tax remained unpaid and it was evident that it was physically impossible for them to meet their normal payments. In the circumstances, enforcement of payment was out of the question and it was decided that payments should be adjusted to the ability to pay and towards this end a far-reaching campaign for collection was instituted with remarkable success. In this connexion, a reassessment of land values was urged to adjust them to present productive values and all provinces were pressed to reorganise and reduce their government expenses to conform with decreased revenues.

A law was passed which, *inter alia,* authorised provincial treasures to prescribe and publish periods specially fixed for the collection of taxes to suit the seasonal differences which affected the harvesting dates of the various crops found in the Islands and to make collections in semi-annual instalments.

In addition, this law empowered municipal councils to levy special assessment against any property to which special benefits accrued as a result of public works.

The Report draws attention to the importance of the small farmer in the Philippines and the necessity for his assistance in any possible way. Towards this end, efforts are being made to promote diversification of crops, to encourage poultry and pig-raising, and the growing of vegetables for home consumption. On the other hand, increases should be envisaged in the tariffs on such articles as can and should be produced on the small farms, provision should be made for the reassessment of land values, to render reasonable credit easy and to curb usury. Assistance should firstly be given to small farmers already settled on the land and every effort should be made to encourage further settlement of small-holders.

This is being achieved by amplification and development of agricultural extension work to the limits of the means available, including lectures, demonstration caravans, model houses and agricultural fairs which encourage competition and in which demonstrations of improved varieties of plants or implements are useful towards broadening the scope of agriculture.

In the fairs, social aspects are stressed and amusements are provided while all prizes are of a practical nature—such as a plough, or a couple of pigs—which are appreciated by the small farmer more than the certificate which is commonly bestowed; free seeds for crops especially adapted to localities are also distributed at fairs and from caravans. Usury is rigorously opposed, not only by the extension of credit on reasonable terms, but by the punishment of usurers.

The Philippine National Bank aims at the extension of credit of the small farmer by granting loans up to P.500 secured by standing crops, or by mortgage of real estate. It also envisages the formation of rural credit societies and the organisation of rural banks. The tenant farmer in the rice-growing areas is protected by a law which provides for written contracts between landlord and

tenant in a dialect known to both, which constitutes a notable advance against one of the most potent abuses in regions where payment is in kind rather than in money.

With a view to increasing the number of small farmers, systematic effort is directed towards the survey of suitable large tracts of land, towards dissemination of information regarding such areas in the regions where land hunger is most patent, and towards the prevention of land speculation by earmarking all public lands contiguous to projected highways for occupation by small-holders only.

Furthermore, the curriculum of the agricultural schools is being remodelled so that the last few years of study will be upon farms, and large tracts of land are being exclusively reserved for demarcation of homesteads for graduates. It is intended that each class will go as a colony to a selected district and settle there, a resident teacher being responsible for the instruction of the boys while they are developing and improving land which will become their own property on graduation.

Although the agricultural population forms the main section of the people, the needs of industrial workers are also to be borne in mind, especially as this class of the community is steadily increasing in number. For this class, laws have been passed regulating the operation of private employment agencies, binding contractors to guarantee the payment of labourers, freeing labourers of any compulsion to purchase food, raiment or any other commodities by any tokens other than local legal tender currency and forbidding the payment of wages except in such currency.

Other laws permit municipal authorities to make free distribution of medicines to labourers under their jurisdiction, to give preferential claims to wage earners, to allow free medical tratment to labourers in establishments where over 30 are employed, to provide for preferential claims to such classes as labourers and domestic servants in cases of insolvency and to make provision for mediation and arbitration between landlords and tenants and between employers and employees.

The Philippines abound in natural resources, the population is intelligent and industrious yet economic development has been faulty in three directions.

Firstly, many agricultural products which can be grown or produced in the Islands are imported, such as pork, coffee, tobacco, fish, eggs, onions, cotton beans and cocoa, the total value of these imports totalling some P. 40,000,000.

Secondly, though raw materials and skilled artisans are numerous, little or no manufacture is in progress whereas commodities such as cotton goods, soap, starch and sacking are imported annually in large quantities.

Thirdly, there is little flexibility of mind so that paths beaten in the past are still closely followed despite changed conditions. Rice cultivation, for instance, only occupies the land for half the year, whereas much rice land could

be used throughout the year by diversification of crops which would materially increase the farmer's annual income as well as supply products for his own consumption.

Towards improving existing conditions the tariff rates, which had altered very little since 1909 despite highly changed times, were investigated and the need for increases became evident, the demand for increased tariffs coming equally from producers, exporters and American manufacturers.

Accordingly, the Legislature amended the general customs policy so that foreign invoice values should be converted into Philippine currency in assessing *ad valorem* duties so as to prevent dumping of foreign goods and in order to dispense with the limit of 100 per cent. in *ad valorem* duties.

In addition, measures were enacted to effect specific upward revision of the tariffs in regard to meat, peanut oil, eggs, footwear and some 70 other products, while tariffs on textiles, steel, wheat flour and motor car tyres were eliminated.

The economic situation in the Philippines appears sound superficially, but its high dependence on the sugar trade with the United States (to which it exported P. 122,000,000 worth of sugar and sugar products in 1932) renders it precarious. This position is aggravated by the possibility of the islands becoming an independent nation and thus losing the advantage of free trade with the United States, since economically, sugar production in the Philippines cannot compare with Java where already over-production exists to the extent of 4,000,000 tons. Thus, it becomes increasingly evident that the islands must devote immediate attention to diversifying products and to developing new markets, especially in China. In endeavours to broaden the base of the economic structure of the Philippines, careful attention is directed towards developing existing industries and creating new ones indicated by undeveloped natural resources or special aptitude on the part of the people, such as is shown by the fishing industry, in regard to which special administration is being established in order to foster it from every aspect.

Similarly, the Manila hemp industry is suffering from competition and low prices and efforts are to be made to find new markets and, if feasible, to utilise the material in manufacture of sacking and other products within the country. Although the natural resources of the country are abundant, they are not inexhaustible and efforts are to be directed against waste and towards the full development of the resources at hand, such as is manifested in the homestead policy under which small rather than large farms are advocated. In like fashion, all water power is declared as part of the public domain and measures have been taken to prohibit the use of poison and dynamite in fishing in the furtherance of conservation of resources.

With regard to education, while much progress has been achieved in the past 30 years, it has been a failure in that ever increasing numbers of youths

have been trained for clerical positions which do not now exist, with the result that graduates have become liabilities rather than assets on the State.

Accordingly, every effort must be made to render school curricula practical so that the young may become capable of maintaining the agriculture and other industries of the country.

It is hoped that this end will be achieved by community assemblies held monthly for adults in the schools and that the local teacher or some Departmental Officer should lecture at each assembly.

A large number of practical lectures is being prepared and translated into the ten Philippine dialects for distribution through the teachers.

The lectures embrace all kinds of subjects and are couched in simple terms, understandable to all, and often accompanied by diagrams or models, while a question period is specified at each assembly.

[The drastic changes in the economic life of the people, the national economic situation and the efforts being made to meet the demands of the times in the Philippines, form a striking analogy with present conditions in Malaya where the people are now being educated to tariffs, particularly on imported food-stuffs which could be grown within the country and where the importance of the peasantry is now being stressed by propaganda work, land settlement, and better methods of manufacturing and marketing their produce while every opportunity for fostering existing industries and initiating new ones is being taken.—*H.W.J.*]

Reviews.

Cooperation in the Hawaiian Pineapple Business.

By Royal N. Chapman. American Council Institute of Pacific Relations. New York 1933. 15 pp.

This pamphlet describes the history and development of co-operation among the pineapple producers of Hawaii.

The Hawaiian canned pineapple industry, which has been in existence for less than forty years, is now controlled and operated by a small group who are both growers and canners, and who produce roughly eighty-five per cent. of the world's supply of this product.

The reader is reminded that of a total world consumption of about fourteen and a half million cases of canned pineapples, Hawaiian production is over twelve and a half million cases and Malaya over one and a half million. The other exporting countries are Formosa, South Africa and Queensland.

Although co-operation in the Hawaiian industry has now been developed to a high state of efficiency, it is pointed out that this result has not been easily brought about. On the contrary, it has been embraced only when the alternative has seemed to be leading to serious financial loss.

Co-operation amongst those engaged in the production of Hawaiian canned pineapples has varied from time to time and includes advertising; the support of research work in connection with the growing, improvement and protection of pineapples; the allotment of space on boats; and, in cooperation with the Hawaiian Sugar Planters' Association, the importation of labour.

The idea of co-operation was first mooted in 1904 and concrete proposals made in the following year. The industry at that time, however, could come to no agreement on the subject. Such co-operation as was proposed would, it is claimed, have prevented the excessive canning capacity which now exists, thus resulting in a great saving of capital; it would also have resulted in a standardization of the product. The fact that one company controlled forty-seven per cent. of the pack and was not interested in the co-operative proposals militated against the adoption of the plans for co-operation.

The advantage of co-operative advertising has twice been demonstrated in the history of the Hawaiian pineapple industry. In both cases, be it noted, the scheme has been forced on the packers by the economic conditions.

Early in 1909, the industry found itself with about seventy per cent. of the entire pack of the previous year still on hand. Faced with this position and with the low price of pineapples, the industry united and with the sum of $50,000 (gold) with which to finance a co-operative advertising campaign, succeeded in disposing of its pack by the middle of June of the same year.

A somewhat similar situation arose in 1912. In this instance the Association of Hawaiian Pineapple Packers was formed and a cess of five cents per

case on the year's pack was imposed to finance the advertising campaign. Assessments have been made more or less continuously from that time for the purpose of advertising.

The need for research work was first evinced in 1914 when the Pineapple Association arranged with the Hawaiian Sugar Planters' Association for a certain amount of work to be done on pineapple problems. In 1922 a further step was taken towards extending the pineapple research work by the lease of 100 acres of land for experimental purposes. Two years later, the research work was withdrawn from the Experiment Station of the Hawaiian Sugar Planters' Association and organised by the University of Hawaii with the support of an assessment on the pack of pineapples—which amounted to a little over one cent a case on the pack. The budget for the work in that year was $96,537; in 1933 the sum of $161,818 was estimated for this work.

The incentive for the development of the research work is stated in the following words:—

> " It is interesting that the initiation of the work with the H.S.P.A. in 1914, the leasing of one hundred acres at Wahiawa for experiment work at the end of 1922, and the setting up of the independent research work at the University of Hawaii from 1924 to 1926 coincided with the three reductions in pack increase in the history of the industry.* It was economic necessity rather than any logical plan or forethought that brought about these three important steps in the history of the industry's cooperative activities."

The establishment of the Experimental Station led to a very much larger potential production of pineapples owing to the introduction of the method of mass planting, whereby the number of plants per acre was increased from a range of 8,000 to 10,000 to one of 12,000 to 20,000, with a corresponding increase in the yield of fruit; and to an expansion into the drier areas following upon a demonstration of the ability of the pineapple to grow under conditions of low rainfall.

Co-operation with the object of obtaining better shipping facilities is a further instance of necessity compelling co-operation. A situation of difficulty arose in 1917 in which, owing to the Great War, the industry was unable to obtain sufficient material for putting up the pack of pineapples. Eventually the packers, in co-operation with shipping companies, effected arrangements whereby they were assured of the supply of all necessary materials to Hawaii and for the transport of the pineapples to the Coast.

The history of how the Hawaiian canned pineapple industry has fared in the present world depression is given in some detail. The acreage under pineapples rapidly increased between 1928 and 1930 and the satisfactory means of controlling wilt, which was announced at about this time, greatly increased the estimated pack in the coming years. The position became so serious that in September 1930 most of the packers agreed to stop short of the end of the season. Consequently, the pack was less than the 13,000,000 cases for which there was fruit in the field. The estimated pack for the following year was

* The reduction in packs on these three occasions are ascribed respectively to wilt, the withdrawal from one area because the production of pineapples there was no longer possible, and pineapple yellow spot.

16,000,000 cases. "With a world depression in full force, and the carryover at the beginning of 1931 equal to sixty-one per cent. of the pack of the year before, the Hawaiian pineapple industry was again faced with conditions similar to those experienced in 1907 to 1909".

In the face of economic depression and with the increased pack, advertising failed to maintain sales; the price of pineapples was cut to below cost of production in spite of which the situation became worse.

It became evident that once again the industry must unite to save itself. Seven pineapples companies were involved and negotiations ensued having for their object an agreement for the reduction of the pack. It was agreed that at least for a period of years the Hawaiian pack should not exceed 10,000,000 cases per annum. A new body—The Pineapple Producers' Cooperative Association—was formed and an advertising campaign organised to spend a million dollars, the cost to be met by an assessment on a basis. It is too early to judge the degree of success of this Association. It is attempting at present, to pool the pineapples as canned and to market them co-operatively.

The pamphlet refers to the situation in the Malayan industry and the need of closer co-operation of canners in order that the industry may be reorganised and established on a sounder basis.

Assuming that such co-operation in the Malayan industry materialises, the author visualises "the formation of an international trade agreement whereby potential sales areas of the world would be allocated, as has been done with certain other industries, thus eliminating competition between co-operatives."

The problems that have arisen in the Hawaiian industry are parallel with those met with in Malaya. The difference is that Hawaii appears to have gone a long way along the road which leads to a permanent solution of the most difficult problems which time and again confront the industry, and which are common to both Hawaii and Malaya. The latter country, therefore, will lose nothing by a very close study of the Hawaiian experience and the manner in which that country hopes to solve its difficulties.

D. H. G.

The West Indian Fruit and Vegetable Industries.

In recent years, considerable developments have taken place in the transport and marketing of fresh fruits. It has been rendered possible primarily by the advance in knowledge of the most suitable temperature conditions at which particular fruits should be maintained during transit. These investigations, undertaken by various low-temperature stations and assisted by the interested co-operation of transport companies—by land and sea—have provided the fruit growers with a wider market. The consumer is now offered a very much wider range of fruits than formerly and in better condition. Furthermore,

the consumer finds that whereas formerly his favourite fruit was procurable for but a short season, nowadays the seasons are lengthened, while many fruits are now procurable throughout the year.

The development of markets has necessitated new series of investigations in many directions. The grading of fruit is no longer sufficient; research is now concerned with the behaviour of varieties of fruit in storage, desirable qualities of fruit from the point of view of packing, ripening quality of fruit and the study of the market with the object of distributing production to ensure continuity of supplies.

This subject and the problems connected with it, is again brought to the fore by the recent publication of the Report, Recommendations and Proceedings of the West Indian Inter-Colonial Fruit and Vegetable Conference, Jamaica, 1933.

Its recommendations, which are succinct, adequately cover the various aspects of the subject. Allusion may be made to certain of these recommendations which may be of particular interest locally.

With regard to limes and lemons; in view of the fact that the lime industry has lost its market for citric acid and to a certain extent, for raw juice and that the demand for its essential oil and fresh fruit is restricted, it is recommended that each Government should discourage further planting. Also growers should be advised of the present position and the desirability of restriction in the interests of the industry. The lemon industry is also overstocked, and producers should be advised accordingly.

Regarding pineapples, the recommendations are stated as follows :—

> "There does not appear to be any immediate possibility of reviving the former export industry in fresh pineapples from the West Indies, but market demands would appear to warrant trial shipments to the United Kingdom and Canada, on a small scale under the supervision of the Department of Agriculture. Suitability of the different varieties to the export trade also requires investigation.
>
> "Caution appears necessary in any consideration of extension of planting on a commercial sale, either for the export of fresh fruit as for production for canning.
>
> "The existing supplies of the canned product are greatly in excess of market requirements, and this condition may be expected to continue for some time. The results of the recently established cannery in British Guiana should be awaited before further commercial canneries are considered in any other West Indian Colony."

An interesting recommendation is that a clearing-house be established for the collection, co-ordination and circulation of information gathered on the various aspects of production and marketing of fruit and vegetables of the West Indies. Bearing on the same subject, it is suggested that Government Departments of Agriculture or Government Marketing Agencies should be responsible for investigation and marketing trials on crops for which an export

market appears to exist and that a Marketing Intelligence Officer for the West Indies Colonies should be appointed to work in Canada. By this appointment the Colonies would be able to maintain direct contact with their markets.

Two West Indian Fruit and Vegetable Councils are advocated with the object of co-ordinating the production and marking of fruits and vegetables from the various Colonies. They would be in close touch with the producers on the one hand and with the markets on the other hand.

The value of advertising is recognised and the suggestion is made that the sum of £2,000 per annum be raised by imposing a cess on produce to be paid by the growers.

Standardization of products is insisted upon by means of grading, packing and marking. The Report states—

> "It is essential to the development and success of the Fruit and Vegetable industries in the West Indian Colonies that only high grade products should be exported, that only varieties approved by competent advisers should be grown and that the products exported should be as uniform as possible in respect of quality, grading, packing and marking."
>
> "These objects can best be achieved by preventing by Law the export of products below recognised market standards."

D. H. G.

The Butterflies of the Malay Peninsula.

By A. S. Corbet and H. M. Pendlebury. 252 pp. Illustrated. Published by Kyle Palmer & Co., Ltd., Kuala Lumpur 1934. $4.50.

The publication of this reasonably priced and non-technical book has filled a long felt want for those who are interested in the butterfly fauna of the Malay Peninsula.

Experienced Lepidopterists, and also those who are sometimes rather uncharitably termed "mere collectors" will be assisted in their work, in no small degree, if advantage is taken of this volume, which comprises, in addition to well drawn up descriptions of some eight hundred species, chapters on the structure, characteristics, life histories, classification, geographical distribution, methods of capture and preservation, on mimetic resemblance, heredity and on the bibliography.

The book is illustrated by two coloured plates, thirty-four text figures, fourteen photographic plates shewing two hundred and thirteen species, ond by two maps.

In view of the fact that most works on tropical butterflies are expensive and therefore not within the means of many people, the publication of this useful volume is welcomed and the authors are to be congratulated on their achievement.

N. C. E. M.

Departmental.

FROM THE DISTRICTS.

The Weather.

Weather conditions varied considerably in different parts of the Peninsula. In Kedah, Penang, Province Wellesley and north west Krian, they were warm and dry with occasional showers. In Perak, heavy showers and high winds resulted in a rainfall above average in most Districts. In Pahang and Selangor, warm dry weather was interrupted by fairly frequent thunderstorms and high winds. In Negri Sembilan, Malacca and Johore, warm dry weather prevailed. In Kelantan and in Singapore Island, the first half of the month was cool and showery, while the second half was warm and dry.

Remarks on Crops.

Rubber.—There was a further rise in the average price of rubber during the month. The highest and lowest prices in dollars and cents per picul recorded for rubber from small holdings were:—Smoked Sheet $14.00 to $22.00; Unsmoked Sheet $11.00 to $20.50; Scrap $3.50 to $9.50. The average Singapore prices for these grades were respectively $20, $18.50 and $8.50 as compared with $19.00, $17.50 and $6.00 in January. Penang prices for Unsmoked Sheet ranged from $15.00 to $20.50 as compared with $13.50 to $16.50 in January.

Wintering was general throughout the month with the usual resultant lower yield of rubber. This factor and the enhanced price of rubber led to more severe tapping and to further extension of the tapped area. For example, a number of holdings in Kedah were observed to be tapped twice daily; in Penang Island the trees were tapped in the early morning by lamp-light; while in Johore, tapping was commenced on a considerable area of holdings containing young rubber trees which had never previously been tapped.

With the rise in price, neglected holdings were cleared and weeded and approved disinfectants were used more freely for the treatment of mouldy rot disease, which also received a check from the dryer weather conditions. Leaf mildew (*Oidium heveae*) was not in evidence, being reported from only one estate in the Negri Sembilan.

In Pahang, attempts to persuade the small-holders to combine and sell their rubber in bulk have begun to meet with success and to result in better prices. A movement is on foot to produce a better quality of smoked sheet by the use of smoke houses worked on a co-operative basis.

In Kelantan, a marked advance was made in the improvement of small-holders' rubber. The original small factory at Pulai Chondong is now used by 54 people and 6 other such factories are being erected on other localities. The sheet prepared sold for $17 per picul, while the wet and dirty lump rubber usually made in this State only realised $9 per picul.

Padi.—The price of padi at the Government Rice Mill, Bagan Serai, was reduced to $1.40 per picul, the roadside price in Krian District being $1.20 per picul. In Kedah and Province Wellesley, the price was even lower, being approximately 95 cents to $1.20 per picul. In other parts of the country, the price ranged from 5 to 12 cents per gantang in the villages, thus showing little change from that obtaining in January.

In Kedah and Malacca, the padi harvest was nearing completion at the end of the month. In the former, yields were on the whole very good and in the latter fairly good. In the Negri Sembilan, the harvest was finished except in Kuala Pilah District. Work was well advanced in Province Wellesley where good crops were recorded. In Krian, in spite of the handicaps of labour shortage and wet weather in the southern areas, good progress was made and an excellent crop was expected. Mention is made of yields varying from 600 to 750 gantangs per acre from certain long-term strains of padi, such as Seraup 36 and 48, in the best deep soil areas. Elsewhere in Perak, harvest was in progress. In Kelantan, a good crop of dry padi was reaped, but harvesting of the rather poor wet padi crop had not commenced.

The pure strain padi have proved their value in several localities. In Kedah, in view of the large supplies of these strains now available and of the excellent results so far obtained by owners who have planted them, a campaign for the wide-spread distribution of the seed is being undertaken. In several localities in Pahang these strains have proved considerably superior to the local varieties of padi, while in northern Johore there has been a spontaneous demand for pure strains from cultivators, which has led to the supply of 531 gantangs of seed from the Pulau Gadong Station in Malacca.

In Northern and Central Johore, the work of preparation for the coming season's crop is commencing and uniform dates for the various operations have been arranged.

Coconuts and Copra.—The price of copra from small holdings remained very low, being $2.30 per picul in Singapore and $2.60 to $2.80 in Penang. Elsewhere it varied according to quality from $1.30 to $2.90 per picul, except that in one locality in Kedah a price as high as $4 per picul was recorded.

In most copra-producing areas, nut prices were correspondingly low, except in the coastal Districts of Selangor, parts of the west coast of Johore and the District of Temerloh in Pahang, where a temporary shortage of nuts, or competition between Malay and Chinese copra makers, or these two factors combined, resulted in a higher price for nuts, which in some cases was such that copra could only be made from them at a loss. Nut prices in Malacca rose slightly owing to considerable exports to the Negri Sembilan.

Padi harvest has somewhat suspended improved copra production and the erection of new kilns in Province Wellesley and Krian, but interest has been maintained and arrangements have been made to commence work as soon as the harvest is finished. In Lower Perak and Johore, progress has been made.

In the latter State, work on the construction of several kilns in Muar and Batu Pahat Districts was commenced and marketing channels received attention.

It is in such difficult times as are now being experienced that the small increase in income obtainable from the preparation of good copra, as compared with that obtainable from the sale of nuts, is of the most importance to owners of coconut holdings, since it may just make the difference between a sufficient and an insufficient supply of food.

Pineapples.—Activity in the pineapple industry increased during the month, but fruit supplies in Singapore were limited so that the three factories operating produced but a small output. In Johore, six factories were working daily, except for five days of the Chinese New Year holiday. Prices for fruits in Singapore were, first quality $3.20, second quality $1.80 per hundred; corresponding prices in Johore ranged from $2.40 to $3.60 and from $1.80 to $2.60.

A scheme for selection of pineapples, with a view to improving the type of fruit, was drawn up and work in accordance with this scheme was commenced both on the Pineapple Experiment Station and on privately-owned pineapple areas in Singapore Island.

Fruit.—In Krian, Malacca and Johore, mango trees were flowering well, while in the latter State a few duku trees were fruiting. In Penang Island, there was a good trade in water-melons, especially during the Chinese New Year, prices realised being 10 to 15 cents each. In Malacca, where the cultivation of this fruit by Malays was extending, the fruit were realising 25 to 40 cents each.

Vegetables.—In Malacca, vegetables grown on padi land cropped with short-term varieties were beginning to find their way into the market. Chillies were being produced in excess of requirements; the balance were sundried and mixed with imported chillies, the price for which has recently shown a rise. Damage to market gardens in Johore by floods during January caused a shortage of supplies of vegetables in that State, while in Singapore Island gardeners in areas which were not damaged by floods during January have benefitted considerably from the rise in price due to reduction of supplies. In Kedah, tomato planting by Malays for sale at the Weekly Fairs was noted in Baling District. In the dry season and in situations near a supply of water, tomato-growing is expected to develop into a successful minor industry in this State.

Tobacco.—Prices for sundried tobacco leaves ranged from $14 to $35 per picul for first quality, except in parts of Johore where prices as high as $60 per picul were obtained. In Kedah, about 26 acres of tobacco were planted. In Province Wellesley and Pahang, low prices have reduced interest in this crop, although some 21 piculs of cured leaf were sold in the Province. In Singapore Island, however, interest continues with a price of $35 per picul for cured leaf.

Coffee.—Prices for locally grown Liberian and Robusta coffee have varied from $13 to $28 per picul, the highest prices being obtained in Kedah. Interest

in coffee cultivation is extending in Pahang, where supplies of seedlings for sale are being maintained at the Agricultural Stations. In Segamat District of Johore, areas of land have recently been alienated to Chinese for the cultivation of coffee as a sole crop.

Agricultural Stations.

Trials of the vegetative propagation of a number of different fruit trees by means of the etiolation method * are being conducted at several of the Agricultural Stations. Rooted shoots of rambutan and Jack fruit were obtained by this method at Bukit Mertajam Station and rooted shoots of rambutan and pulasan at the Pineapple Experiment Station, Singapore. At the latter, grafts of mango, pulasan, rambutan and avocado pear were obtained by approach grafting.

At Bukit Mertajam Station, experiments with groundnuts showed that yields from rows which received a dressing of lime at the rate of 1 ton per acre in addition to cattle manure gave approximately twice the yield obtained from the rows that received the same quantity of cattle manure alone. This result supports previous experiments on Castleton Estate in 1916.†

The imported fowls at the Government Experiment Station, Tanah Rata, continued to lay well. The number of eggs obtained varied according to breed from an average of 16 to an average of 22 per pullet for the month. Of these 53 per cent. were over 2 ozs. each in weight and 47 per cent. were between 1½ and 2 ozs. each.

Padi Test Plots.

Harvest was completed at Titi Serong Padi Station and on all Test and Multiplication Plots in Krian, except the Briah Test Plot. Yields were good. Seraup 36 and 48 and Siam 76 were outstanding at the Kuala Kurau Plot. At the Temerloh Plot in Pahang, Nachin 27 doubled its yield as compared with last year's crop, but for some reason F.S. 875 showed a much decreased yield of 448 as compared with 560 gantangs per acre in the previous season. At the Rembau Plot in the Negri Sembilan, some of the pure strains ripened very unevenly, each variety having a maturation period varying by some 50 days, thus Nachin 66 gave a period of 238—291 days and Seraup 48 272—322 days. At the Pulau Gadong Station in Malacca, some selections of Padi Milek from Pahang gave very promising yields which were as good as, or better than, the local Nachin and Siam selections, while the straw of the Milek strains was much stronger.

At Dong Test Plot in Pahang, plots of short-season varieties of padi have been planted to test the possibility of obtaining two crops in a year. At Pulau Gadong Station, one acre was planted for the same purpose with the short-term padi Radin Siak.

* *Malayan Agricultural Journal,* February, 1934, page 58.

† *Malayan Agricultural Bulletin,* Vol. IV, page 376.

Beds of padi straw for the cultivation of the mushroom, *Volvaria volvaceae*, were established at Telok Chengai, Rembau, Pulau Gadong and Sungei Udang Stations with spawn from Bukit Merah Station. A bed in the office compound in Kedah started to produce mushrooms 26 days after the spawn was built into it.

Rural Lecture Caravan.

The Caravan visited Lower Perak from February 5th. to 18th. when lectures and demonstrations on the production of improved copra were given. Audiences evinced much interest in the display of models of kilns and samples of copra illustrating the effect of various faults in harvesting and preparation.

From February 20th. to 28th. a visit was paid to Sabak Bernam sub-District, the subjects dealt with being copra production, padi cultivation and rat control in padi fields.

Copra Course.

A course of instruction on the erection of improved copra kilns and the preparation and marketing of improved copra was given at the Coconut Experiment Station Klang to 13 Malay Agricultural Officers and Headmen from Kelantan, Pahang, Malacca, Province Wellesley and Singapore from February 20th. to 3rd. All those attending exhibited a lively interest in the information given.

Malayan Padi Competition.

Judging of entries at six local padi shows in the Alor Gajah District of Malacca was carried out during the month in accordance with the new scheme for the Malayan Padi Competition described in the *Malayan Agricultural Journal* for December, 1933, page 682.

DEPARTMENTAL NOTES.

Appointment to Federal Council.

With the approval of His Majesty the King, His Excellency the High Commissioner has been pleased to appoint the Director of Agriculture, Straits Settlements and Federated Malay States, to be a member of the Federal Council with effect from the 8th. January, 1934, inclusive.

Tours and Visits of the Director.

The Director of Agriculture visited Singapore on February 14th. and 15th. for the purpose of attending two emergency meetings prior to the departure of His Excellency the Governor. He also inspected the Pineapple Station at Lim Chu Kang.

On February 16th. he proceeded to Pahang and met the British Resident, Pahang, at Temerloh for the purpose of discussing questions in connection with the proposed Government rice mill at that point.

Subsequently, he toured the State of Pahang and inspected all official agricultural undertakings and discussed departmental questions with the State Agricultural Officer and other officers. He returned to Kuala Lumpur on February 26th.

Advisory Committee for the School of Agriculture.

A meeting of the Advisory Committee for the School of Agriculture, Malaya, was held on February 8th.

It was agreed that the fees of students domiciled outside the Straits Settlements and Federated Malay States be fixed at $420 per annum for the Two Years Course and $210 for the One Year Course.

The Straits Settlements and the Federated Malay States Governments have offered a number of Major and Minor Agricultural Scholarships for each year, the precise number of which will be determined from year to year. Six scholarships of each grade were awarded for the F.M.S. in 1933 and the same number is offered this year, as against three of each for the Colony. The latter scholarships are not confined to Malays.

The Chairman stated that the number of applications for admission to the School next May, particularly as Private Students, was already extremely satisfactory. The proportion of Chinese amongst present candidates is large.

The Committee expressed its satisfaction with the School's progress during the past year, and with its immediate prospects.

Leave.

Mr. T. D. Marsh, Assistant Agriculturist, has been granted full-pay leave for 8 months and 8 days with effect from 17th. February, 1934.

Statistical.

MARKET PRICES.

February 1934.

Rubber.—The market price of rubber has remained steady during the month, opening at 16 cents per lb. for Spot loose in Singapore and closing at $16\frac{1}{8}$ cents per lb. The average price for the month was $16\frac{1}{4}$ cents per lb. in Singapore, $4\frac{7}{8}$ pence in London and $10\frac{1}{4}$ cents Gold in New York, as compared with $14\frac{1}{2}$ cents, 4 13/32 pence and $9\frac{1}{8}$ cents Gold respectively in January.

Weekly prices during February for small-holders' rubber at Kuala Pilah, Negri Sembilan; Kuala Kangsar, Perak, and Batu Pahat, Johore, were as shewn in the following table:—

Grades	VALUE PER PICUL (dollars)									
	Kuala Pilah, Negri Sembilan.		Kuala Kangsar, Perak.				Batu Pahat, Johore.			
	15.2.34	22.2.34	31.1.34	14.2.34	21.2.34	28.2.34	7.2.34	12.2.34	21.2.34	28.2.34
Rubber *	17.00	17.26	17.98	18.49	17.23	18.52	16.48	18.75	19.11	19.60
Scrap		5.00								

Palm Oil.—The course of the market Liverpool/Continent during February on a basis of 5 per cent. f.f.a., c.i.f. was as follows:—February 7th. £14.10.0 per ton net, February 21st. £14.10.0 per ton net, and February 28th. £14.15.0 per ton net.

Prices in the U.S.A. landed weight per pound in bulk c.i.f. New York/Philadelphia were 2.62 cents Gold on the 7th. February, 2.60 cents Gold on the 21st. February, and 2.75 cents Gold on the 28th. February.

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* Wet unsmoked sheet.

Transport by lorry Kuala Pilah to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent.

The price of palm kernels Fair Average Malayan Quality c.i.f. landed weight on the Continent was shillings 7/3 per cwt. on February 7th., shillings 7/3 per cwt. on February 21st., and shillings 7/1½ per cwt. on February 28th.

Copra.—The price of copra remained steady during February. The highest Singapore price for Sundried during the month was $3.05 per picul, and the lowest price $2.95 per picul, the average price per picul being $3 as compared with $2.94 during January. The mixed quality averaged $2.40 per picul as compared with $2.29 in January.

Coffee.—The price at Singapore for Sourabaya coffee increased considerably; prices ranged according to grade, from $18.50 to $21.50. Palembang coffee averaged $17.19 per picul during the month, being quoted at $16.50 on the 1st. and $18 on the 23rd; the average figure for January was $13.12.

Arecanuts.—Palembangs averaged $3.73 per picul as compared with $2.92 in January, the rise in price being once again very considerable. The range of Singapore prices for other grades was Red Whole $3.50 to $5.50 per picul and Sliced $8 to $12 per picul.

There were no stocks of Bila Whole, Splits or Kelantan.

Rice.—The average wholesale price of Siam No. 2 ordinary rice per picul in Singapore in January 1934 was $2.91, as compared with $3.18 in December 1933; the average price for the year 1933 was $3.53. No. 1 Rangoon rice averaged $2.72 per picul in January, as compared with $3.11 in December 1933 and $3.04 for the year 1933. Saigon No. 1 (long grain) averaged $2.65 per picul. The average price of this rice in the year 1933 was $3.32 per picul.

Tea.—During January, the average price quoted in London for Malayan tea was shillings 1/2.74. Average prices during January for tea consignments from other countries were as follows:—Ceylon shillings 1/3.97; Java, shillings 1/0.23; Indian Northern, shillings 1/2.89 and Indian Southern, shillings 1/2.67.

Gambier.—The price of Block gambier remained steady during February, averaging $3.88 per picul, Cube No. 1 averaged $6.38. Corresponding figures for January were $3.85 and $6.35 respectively.

Pineapples.—There was a further slight increase in value during February, the average Singapore price per case being as follows:—Cubes $3.24, Sliced Flat $3.06 and Sliced Tall $3.19, as compared with $3.17, $3.05 and $3.13 respectively during January.

Tapioca.—The price of Flake Fair averaged $5.11 per picul as compared with $4.85 in January. Pearl Seed averaged $5.88 per picul and Pearl Medium $6.38 per picul, both slight increases on the average prices in January, namely, $5.60 and $6 respectively.

Sago.—Pearl-Small Fair decreased slightly in price during February, averaging $3.76 per picul for the month; the average price was $3.94 in January. Flour-Sarawak Fair averaged $1.95 per picul as compared with the January average of $1.92 per picul.

Mace.—Prices were nominal during February, the average for the month for Siouw being $65 per picul and $40 for Amboina.

Nutmegs.—110's averaged in price during February $21.25 per picul, as compared with $20 per picul in January; 80's increased slightly in value, averaging $24.25 per picul against the figure of $23.60 per picul in January.

Pepper.—Average Singapore prices during February were as follows:—Singapore Black $15.50 per picul; Singapore White $29.12 per picul and Muntok White $30.50 per picul; the corresponding figures for January were $15.30, $30.50 and $32.60 per picul respectively.

Cloves.—Prices continued steady and nominal as in the previous month; Zanzibar averaged $35 per picul, and Amboina $45 per picul.

Tuba Root.—Roots evaluated on the basis of ether extract averaged $25 per picul in the month, whilst good rotenon-containing roots averaged $30.50 per picul, being a similar average price to that of January.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co., Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Mackay & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY.*

January 1934.

Malaya.—The gross imports of rice into Malaya during January 1934 amounted to 45,510 tons, as compared with 48,972 tons in January 1933, while exports were 10,655 tons in January of this year as against 14,120 tons in January 1933.

Of the imports during January 1934, 61 per cent. were consigned to Singapore, 10 per cent. to Penang, 6 per cent. to Malacca, 22 per cent. to the Federated Malay States and 1 per cent. to the Unfederated Malay States. Of the total imports, 72 per cent. were from Siam, 20 per cent. from Burma, 7 per cent. from Indo-China and 1 per cent. from other countries.

Of the total exports during January, 77 per cent. were shipped to Netherlands India and 23 per cent. to other countries. The various kinds of rice exported were as follows:—Siam rice 6,490 tons, (61 per cent.) Burma rice 3,398 tons, (32 per cent.) Indo-China rice 536 tons, (5 per cent.) Indian rice (parboiled) 39 tons and local production 192 tons (2 per cent.).

Net imports of rice into Malaya in January 1934 were 34,855 tons as compared with 34,852 tons in January 1933.

India and Burma.—The total foreign exports of rice in December 1933 were 74,000 tons, and the total exports for the year 1933, 1,832,000 tons as compared with 2,075,000 tons in the previous year.

The final forecast of the rice crop in Burma for the season 1933—34, issued on February 15, 1934, gives the area likely to mature as 12,440,300 acres. The exportable surplus of the 1933—34 crop is still estimated at 4,324,000 tons of padi, which is equivalent to 3,200,000 tons of rice and rice products.

Japan.—Formosa. The area under padi (second crop) 1933 was 961,037 acres as compared with 941,108 acres in 1932; production was 620,350 tons in 1933 as compared with 663,000 tons in 1932.

French Indo-China.—Exports of padi into Cholon were 72,000 tons in January 1934, a similar figures to that for January 1933. Exports of rice in January 1934 were 95,000 tons, as against 74,000 tons in January 1933.

Netherlands India. (Java and Madura).—No further information to that published in the Summary for the month of December 1933, is available.

Ceylon.—Imports of rice for the year 1933 amounted to 439,893 tons as compared with 441,952 tons in 1932.

Of these imports, 18 per cent. were from British India, 72 per cent. from Burma, nil from the Straits Settlements and 10 per cent. from other countries.

Europe and America.—Quantities of rice shipped from the East were:—

(*a*) To Europe, 1,244,668 tons during the year 1933 as compared to 1,018,236 tons during 1932, an increase of 22 per cent. Of these shipments 46 (52) per cent. were from Burma, 2 (2) per cent. from Japan, 44 (38) per cent. from Saigon, 7 (5) per cent. from Siam, 1 (3) per cent. from Bengal; the figures for 1932 being in brackets.

*Abridged from the Rice Summary for January 1934 compiled by the Department of Statistics, S.S. and F.M.S.

(*b*) To the Levant, (Jan. 1 to Dec. 18) 24,078 tons for 1933 and 49,437 tons in 1932, shewing a decrease in 1933 over the same period of previous year of 51 per cent.

(*c*) To the West Indies and America (Jan. 1 to Dec. 20) 165,452 tons in 1933, as compared with 126,277 ton in 1932, an increase in 1933 of 31 per cent. over the same period of previous year

MALAYAN AGRICULTURAL EXPORTS JANUARY 1934.

PRODUCT.	Net Export in Tons.		
	Year 1933.	January 1933.	January 1934.
Arecanuts ...	20,756	2,407	3,612
Coconuts, fresh ...	100,609†	7,015†	6,515†
Coconut oil ...	17,568	1,618	1,763
Copra ...	110,543	14,584	9,263
Gambier, all kinds ...	2,560	181	173
Palm kernels ...	1,983	65	160
Palm oil ...	12,101	405	297
Pineapples canned ...	59,582	4,713	4,667
Rubber ...	459,836§	35,822§	41,773§
Sago,—flour ...	7,648	656	1,525
,, —pearl ...	2,646	129	255
,, —raw ...	4,420*	495*	464*
Tapioca,—flake ...	9,881	940	649
,, —flour ...	702*	315	184*
,, —pearl ...	17,297	1,056	1,099
Tuba root ...	569½	4	44½

† hundreds in number. * net imports. § production.

MALAYA RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING JANUARY, 1934.

State or Territory	Acreage of Tappable Rubber end 1932 (d)	Estates which have entirely ceased tapping		Estates which have partly ceased tapping		Area of Tappable Rubber never been tapped		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
STRAITS SETTLEMENTS :—									
Province Wellesley	44,734	1,323	2.9	7,243	16.2	1,016	2.3	8,566	19.1
Dindings	6,969	209	3.0	773	11.1	546	7.8	982	14.1
Malacca	111,780	4,619	4.1	15,944	14.3	6,393	5.7	20,563	18.4
Penang Island	1,635	365	22.3	77	4.7	180	11.0	442	27.0
Singapore Island	28,269	8,621	30.5	4,821	17.0	207	.7	13,442	47.5
Total S.S. ...	193,387	15,137	7.8	28,858	14.9	8,342	4.3	43,995	22.7
FEDERATED MALAY STATES :—									
Perak	250,951	3,954	1.6	27,919	11.1	14,679	5.8	31,873	12.7
Selangor	308,379	5,033	1.6	36,499	11.8	10,155	3.3	41,532	13.4
Negri Sembilan	228,541	4,763	2.1	20,065	8.7	14,172	6.2	24,828	10.8
Pahang	38,141	5,297	13.9	4,442	11.6	4,859	12.7	9,739	25.5
Total F.M.S. ...	826,012	19,047	2.3	88,925	10.7	43,865	5.3	107,972	13.0
UNFEDERATED MALAY STATES :—									
Johore	325,747	21,932	6.7	32,499	10.0	23,227	7.1	54,431	16.7
Kedah (a) (b)	114,551	3,595	3.1	9,556	8.3	(e) 5,700	5.0	13,151	11.4
Kelantan	21,175	5,749	27.1	2,200	10.4	1,860	8.8	7,949	37.5
Trengganu (c)	4,352	Nil	Nil	1,561	35.9	30	.7	1,561	35.9
Perlis (a) (b)	957	106	11.1	131	13.7	308	32.2	237	24.8
Total U.M.S. ...	466,782	31,382	6.7	45,947	9.9	31,125	6.7	77,329	16.6
TOTAL MALAYA ...	1,486,181	65,566	4.4	163,730	11.0	83,332	5.6	229,296	15.4

Notes :—(*a*) Registered companies only and are rendered quarterly.
(*b*) The figures quoted for Kedah and Perlis are those for end December 1933, revised figures will be published when available.
(*c*) Registered Companies only.
(*d*) Figures for end December 1933, are not yet available.
(*e*) Estimated: figures not yet available.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF JANUARY 1934 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month		
	Ports	Dealers	Estates of 100 acres and over	during the month	January 1934	during the month	January 1934	during the month: Foreign	during the month: From Malay States & Labuan	January 1934: Foreign	January 1934: From Malay States & Labuan	during the month: Foreign	during the month: Local	January 1934: Foreign	January 1934: Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES:—																		
Federated Malay States ...	...	12,715	12,728	12,341	12,341	9,763	9,763	Nil	Nil	Nil	Nil	14,447	8,509	14,447	8,509	...	12,267	12,309
Johore ...	...	3,305	3,182	3,244	3,244	4,563	4,563	Nil	6	Nil	6	1,810	6,104	1,810	6,104	...	3,362	3,024
Kedah ...	...	538	2,294	3,126	3,126	1,967	1,967	Nil	Nil	Nil	Nil	1,231	3,801	1,231	3,801	...	406	2,487
Perlis ...	...	28	15	21	21	34	34	Nil	Nil	Nil	Nil	Nil	65	Nil	65	...	24	9
Kelantan ...	...	215	203	190	190	935	935	108	Nil	108	Nil	54	1,009	54	1,009	...	393	195
Trengganu ...	...	55	50	200	200	99	99	Nil	Nil	Nil	Nil	Nil	299	Nil	299	..	55	50
Total Malay States	...	16,856	18,472	19,122	19,122	17,361	17,361	108	6	108	6	17,542	19,787	17,542	19,787	...	16,507	18,074
STRAITS SETTLEMENTS:-																		
Malacca ...	...	2,734	1,293	1,322	1,322			1		1		4,238		4,238		...	2,649	1,220
Province Wellesley	...	1,067	602	630	630			Nil		Nil						...	1,029	692
Dindings ...	...	59	154	115	115			Nil		Nil						...	70	139
Penang ...	2,354	5,465	8	20	20	3,047	3,047	1,935	19,908	1,935	19,908	8,133	Nil	8,133	Nil	2,939	6,536	13
Singapore ...	5,955	31,110	149	156	156			14,084		14,084		25,346		25,346		6,159	32,045	143
Total Straits Settlements	8,309	40,435	2,206	2,243	2,243	3,047	3,047	16,020	19,908	16,020	19,908	37,717	Nil	37,717	Nil	9,098	42,329	2,207
TOTAL MALAYA	8,309	57,291	20,678	21,365	21,365	20,408	20,408	16,128	19,914	16,128	19,914	55,259	19,787	55,259	19,787	9,098	58,836	20,281

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
20	21	22	23	24	25	26
DRY RUBBER	8,566	27,381	5,636	3,449	1,335	122
WET RUBBER	3,701	4,664	900	299	2,027	284
TOTAL ...	12,267	32,045	6,536	3,748	3,362	406

TABLE III
FOREIGN EXPORTS

PORTS	For month	January 1934
Singapore ...	36,726	36,726
Penang ...	12,186	12,186
Port Swettenham.	5,551	5,551
Malacca ...	796	796
MALAYA ...	55,259	55,259

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January 1934
Malay States ... Straits Settlements	40,311	40,311
MALAYA ...	40,311	40,311

Notes:—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + 22 tons local consumption during the month —[2]—[3]—[4]—[5]—[9]—[10]. For the Straits Settlements, Columns [9] and [10] represent purchases by dealers from local estates of less than 100 acres, reduced by 15 % to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15; wet sheet, 25 %; scrap, lump, etc., 40 %; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5 The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 23rd February 1934.

METEOROLOGICAL SUMMARY, MALAYA, JANUARY, 1934.

Locality	Air Temperature in Degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total	Total	Most in a day Amt.	Number of days: Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total	Daily Mean	Per cent
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.								
Railway Hill, Kuala Lumpur, Selangor ...	87.9	70.8	79.3	92	67	79	73	82.3	83.3	11.08	281.4	3.28	15	10	2	5		147.35	4.75	40
Bukit Jeram, Selangor ...	85.9	71.0	78.4	89	68	80	73	81.5	83.7	9.33	237.0	3.52	18	17	1			154.75	4.99	41
Sitiawan, Perak ...	86.9	70.6	78.7	92	63	80	74	82.0	83.3	11.62	295.2	2.86	19	18	3	4		174.00	5.61	48
Temerloh, Pahang ...	82.9	70.3	76.6	90	66	75	73	80.4	83.4	10.24	260.1	3.23	23	19		5		131.40	4.24	36
Kuala Lipis, Pahang ...	82.6	69.8	76.2	89	66	75	73	80.2	82.0	16.32	414.5	3.81	22	20		23		120.20	3.88	33
Kuala Pahang, Pahang ...	81.6	74.5	78.1	84	70	78	77	79.9	81.5	10.71	272.0	2.38	19	19				144.60	4.66	39
Mount Faber, Singapore ...	82.6	70.9	76.7	87	67	71	73	77.7	79.4	18.94	481.1	6.20	18	15		1		117.80	3.80	31
Butterworth, Province Wellesley ...	87.1	71.5	79.3	91	66	83	74	82.9	84.1	3.84	97.5	0.79	14	14	1	1		210.55	6.79	57
Bukit China, Malacca ...	83.4	72.1	77.7	87	70	77	74	78.9	80.9	8.06	204.7	1.53	18	15				119.85	3.87	32
Kluang, Johore ...	81.7	70.8	76.3	88	66	73	74	77.9	79.8	25.36	644.1	5.88	20	17		1	2	117.95	3.80	32
Bukit Lalang, Mersing, Johore	80.7	73.2	76.9	83	67	78	76	78.0	79.3	8.82	224.0	2.28	21	17				138.30	4.46	37
Alor Star, Kedah ...	87.6	69.8	78.7	91	62	83	73	81.9	83.9	2.94	74.7	1.36	6	4	2	1		208.55	6.73	55
Kota Bahru, Kelantan ...	83.0	71.4	77.2	85	62	80	76	80.1	82.0	3.46	87.9	0.47	21	17				174.25	5.62	48
Kuala Trengganu, Trengganu	82.3	72.0	77.1	85	63	80	76	79.0	80.6	5.34	135.7	1.53	18	13				132.95	4.29	36
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. Pahang ...	66.9	59.6	63.3	73	56	62	62	68.2	69.7	15.31	388.9	3.23	24	23		20		63.10	2.03	17
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	69.4	57.1	63.3	73	43	66	62	67.5	68.4	5.52	140.2	1.05	16	14			6	128.15	4.13	35
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	68.5	56.9	62.7	75	51	64	60			5.60	142.3	0.89	18	14			6	129.05	4.16	35

Compiled from Returns supplied by the Meteorological Branch, Malaya

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THE

Malayan Agricultural Journal.

APRIL, 1934.

EDITORIAL.

Agriculture in Trengganu.

The State of Trengganu, although the fourth largest of States in the Malay Peninsula, is probably the least known. Its geographical position has, no doubt, been partly responsible for the fact that development has proceeded at a much slower rate than it has in States more favourably situated. It contains, however, a very considerable population of Malays, and undoubtedly possesses great possibilities of development.

At the invitation of the State, Mr. J. A. Craig, Principal Agricultural Officer in the neighbouring State of Kelantan, visited Trengganu to report on the position of agriculture in that area and to make recommendations regarding the improvements possible.

The visit was made in November 1933, and his report and recommendations presented to the Government of Trengganu which is giving its consideration to the proposals outlined by Mr. Craig. Until such proposals have been accepted as the policy of that Government, publication would be premature. The descriptive portions of the Report, however, are of general interest, in view of which, we have the permission of the Trengganu Government to publish it in this Journal.

Rat Control in Krian.

The widespread damage by rats to standing crops of padi has been a subject of great concern to administrative and agricultural officers for many years past.

In the Krian irrigation area, with its wide stretches of padi land, the situation became so acute some years ago that it was necessary to organise a campaign to reduce this pest.

Concerted action by the padi-growers themselves was almost out of the question at that time. There was little or no cohesion amongst them, and the matter was of such urgency that time could not be wasted in educating them, and bringing them to a state of mind when they could launch a campaign of destruction with any reasonable expectation of success.

Consequently, the Government undertook systematic work of destruction, resulting in a considerable measure of success. Gradually, the position has changed. The rats are still present and so long as padi is grown, a ceaseless

war must be waged to keep their numbers down. But demonstrations, lectures and perhaps a fuller realisation of the danger, have resulted in a more enlightened attitude amongst the padi-growers and, in particular, amongst the headmen.

A new phase in this work has, therefore, come into existence in which the onus of first responsibility for the work has been shifted from the shoulders of the higher authorities, who hitherto had been responsible for the campaign, to the shoulders of the local headmen. In an article in this number on "Rat Control in Krian" an account is given of the present methods of control and of the measure of success so far attained.

While we repeat that ceaseless vigilance is necessary, in consequence of which supervision by this Department and by the administrative officers is still necessary, the measure of success attained is most promising and the amount of work done by the local headmen worthy of great praise.

Marketing of Eggs.

Attention has been drawn from time to time in the pages of this journal and in the Annual Reports of this Department, to the very large importation into Malaya of poultry and eggs. These imports, of course, represent only a portion of the total local consumption, for in many districts of Malaya systematic collection of poultry and eggs is made by Chinese dealers, who forward the produce to the larger markets.

It is desirable that the local production and marketing of poultry and eggs should be encouraged, and it is thought that the difficulties that are encountered are not insuperable. The Department of Agriculture is at present actively engaged in research work on the improvement of the local stock, while an officer of wide local experience in poultry husbandry has been engaged to instruct and encourage the small-holder in the breeding and care of poultry.

Scientific poultry-rearing in Malaya is as yet in its infancy. We seek knowledge on almost every aspect of the problem, in particular on diseases, stock suitable for the country and on correct and economic feeding.

There remains, however, the ever-present problem of marketing. To stimulate interest in poultry keeping we must be able to indicate marketing channels. It is a subject, therefore, that may be persued at once and need not wait for results of research work in other directions. In fact, the existence of organised marketing channels, such as may be provided by recognised co-operative societies, may be, and undoubtedly will be, used as a medium for introducing any improvements which become established.

It will be realised therefore, that constructive work with the object of increasing the local production of poultry and eggs, needs not only the collaboration of the Departments of Agriculture and Veterinary Science, but close touch with the Co-operative Societies Department. We would remark, in passing, that such collaboration exists; the Departments concerned systematically interchange reports on the lines upon which they are working and of the progress made,

while an Inter-Departmental Marketing Committee, composed of representatives of these Departments, meets regularly for the purpose of discussing problems of common interest in this connexion.

It may be thought that we have digressed from the title of this editorial, *viz.* "The Marketing of Eggs", but it was our object to indicate the reason why articles such as that published in this number on "The Co-operative Marketing of Eggs in Malaya" is of interest, not only on account of the valuable work of organisation which it describes, but also for the potential uses to which such societies may be put in the furtherance of the objects which the different departments approach—each from its own angle.

The four Societies at present actively engaged in the marketing of eggs are the pioneers of what, we hope, may grow into an important organisation. The Societies deserve the support of the public which we trust will be forthcoming.

Fish Production in Krian.

In previous numbers of this journal* accounts were given of the methods recommended for fish-rearing in Malaya. Considerable publicity was given to these articles. They were translated into the Malay and Chinese languages for publication in the vernacular journals of this Department and were reprinted in several vernacular newspapers in Malaya.

As a result of this publicity, and of further work by the Fisheries Department and by the Field Branch of the Department of Agriculture, carp-rearing has increased in the country.

In the present number of this journal we publish an article on "Fish Production in the Krian Irrigation Area" which recounts the varieties of fish favoured in that locality, and gives additional information concerning the yield of fish obtained and of its value.

One cannot but be struck by the very large yields that can be obtained from quite a small pond and of the value of carp-rearing as a subsidiary industry to other forms of agriculture—padi planting in particular.

In many districts where flesh foods are scarce and form but a small item in the diet of the poorer native, fish is of particular value; but away from the seaboard and rivers, it is generally expensive. The encouragement of fish-rearing in such localities appears indicated. With lack of transport facilities in many country districts, the establishment of numerous fish ponds seems desirable. This might reduce the amount of imported dried fish consumed in Malaya, a result which would be of benefit to the country and to the health of the individual.

*Rearing of Carp in Ponds, *Malayan Agricultural Journal*, Vol. XIX No. 8.
Transport of Carp Fry from China, *Malayan Agricultural Journal*, Vol. XIX No. 10.

RAT CONTROL IN KRIAN, PERAK

BY

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and

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Introductory.

An indication of the extent to which rats are capable of damaging the Krian padi is afforded in an article by H. W. Jack, entitled "Destruction of Rats"* which states that at least six per cent., or about one million gantangs of the crop, in the Krian District of Perak was at that time destroyed by the pest.

In order to reduce this extensive loss, an organised campaign was instituted by the Department of Agriculture, and launched in November 1924,† over a selected area of some 30,000 acres comprising some of the highest-yielding rice fields in Krian.

Original Scheme.

Control Measures.

Initial control measures were based upon a Government subsidy for destruction, a monetary reward of one cent per tail being paid upon presentation at definite collecting and paying centres. Poison baits and traps were issued free, and endeavours were made to popularise various forms of organised hunting.

The results obtained from this campaign were considered to be sufficiently satisfactory to warrant an extension to cover the whole of the Krian District. The extended campaign was commenced in May 1925,‡ one European Officer, with five Malay Assistants being made responsible for the organisation.

The result of the campaign under the caudal system appears to have been satisfactory up to the end of 1929, in so far as no extensive damage to the standing crop was sustained. During the 1930-31 season, however, despite a substantial increase in rats slaughtered, the crop was severely damaged over an aggregate area of some five hundred acres, slighter damage occurring over a much larger area.

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* *Agricultural Bulletin of the F.M.S.* Vol. IX p. 271—276.

† Progress Report on a Campaign against Rats in Krian District, November 15th, 1924—March 31st, 1925. *Malayan Agricultural Journal*, Vol. XIII (1925) p. 168.

‡ Report on the Rat Campaign in Krian between the period May 15th, and end of August 1925. *Malayan Agricultural Journal*, Vol. XIII (1925) p. 364.

Tails accounted for up to the end of 1930 are given hereunder:—

Year		Tails paid for
1925	...	661,794
1926	...	673,102
1927	...	824,791
1928	...	914,644
1929	...	623,712
1930	...	1,791,790

Conclusions.

Experience gained over the period of subsidised destruction indicated the necessity for complete re-organisation of the system, since it was realised that a considerable expenditure was not providing an adequate measure of protection of the standing padi crop against damage by rats. One reason for this was believed to be that there was no great enthusiasm among the actual padi producers to undertake the capture of rats in order to gain the reward. Much of the money disbursed in rewards was collected by Tamil labourers and often for rats captured outside the padi-growing areas. A system on a re-organised basis was planned, and put into effect during 1931.

Modified Scheme.

It is unnecessary to indicate here the many disadvantages that were discovered to be associated with a system that rewarded the cultivators for undertaking the service of protecting their own interests, but it was decided that, in any modified scheme, the payment for tails must cease.

The District of Krian is subdivided into eight "mukims"; these again are subdivided into seventy-one smaller units of area, each under the control of a head-man styled *Ketua Parit*. It was suggested by Mr. J. D. M. Smith, then District Officer, Krian, that the *Ketua Parit* area should be the unit on which a new policy might be based, each *Ketua Parit* being responsible for the active co-operation of cultivators within his area. In return for the added responsibility, the *Ketua Parit,* in whose territory control measures had been efficiently maintained throughout the season, might be remunerated by a small cash bonus consistent with the results achieved.

Organisation.

The original campaign was controlled by the Senior Agricultural Officer in the State, stationed at Taiping, through a European Rat Destruction Officer and nine temporary Malay Assistants, each assistant being in charge of a definite number of *Ketua Parit* areas, in which *mukim* boundaries were observed in order to induce some measure of competition. Responsibility for rat destruction was transferred directly to the cultivator, the departmental organisation being concerned with the supply and distribution of traps and poison, and the supervision and demonstration of their effective use, together with extensive propaganda and instruction work throughout the District.

Control Measures.

Poison.

Sodium Arsenite. This poison has been found to yield satisfactory results, and after careful experimentation, the following formula was evolved for use and is considered to be effective and economical:—

Rice polishings	...	46 ozs.
Tapioca flour	...	45 „
Tallow	...	4 „
Palm Oil	...	47 „
Water	...	24 „
Salt	...	3 „
Sodium arsenite	...	18 „

These quantities were found to give a volume which could conveniently be mixed by one man in a small "Shanghai" jar, and which produced a mass of good consistency with a pleasant odour, machined easily, balled well and dried in a short period. A rapid method of balling has been evolved by passing the mass through an ordinary culinary mincing machine fitted with a plate containing a number of small round holes, about one quarter inch diameter, through which the material is delivered.

The cost per ton of the mixture, excluding making, packing and supervision is $98.83 (Straits Settlements currency). One ton of the mixture is sufficient for some 2,240,000 poison balls. These balls are readily taken by the rats and prove very effective. The flavour and aroma can be changed occasionally with advantage by substituting a small quantity of dried fish or prawns, for a similar weight of polishings and tapioca flour.

With a large-sized machine, four men could in a week, make, dry, and pack up to one ton of poison balls.

The baits were laid at frequent intervals along *batas* and bunds, especially at or near the entrance to holes. Roadside drains, village boundaries and waste land were treated in a similar manner, except that near any habitation the bait was usually placed in a bamboo to prevent it being taken by domestic animals. It is considered that rats are attracted by freshly turned ground, and a little scraping of the soil near the bait was advocated.

Cultivators prefer to mix the prepared poison baits with tapioca roots, fish or coconut, to render them more attractive. To allay suspicion, the baits are usually concealed beneath a small heap of padi husk, and it is claimed that, by employing this method, baits are more readily taken.

Barium carbonate. This material can be handled and used with a greater measure of safety than sodium arsenite, and is very effective in destroying rats. Baits prepared in accordance with the following formula have been used with success in Krian:—

Rice polishings	...	48 ozs.
Tapioca flour	...	48 ,,
Barium carbonate	...	64 ,,
Tallow	...	4 ,,
Palm oil	...	48 ,,
Water	...	48 ,,

Freshly prepared baits should immediately be placed on dry racks, and dried in the sun before use or storage, to prevent possible mould growth and consequent deterioration.

The cost of the ingredients for the preparation of one ton of poison balls, is approximately $80 (Straits). The method of manufacture is similar to that used in connexion with sodium arsenite.

Certain insects, more especially cicadas, grass-hoppers and dragon flies, are particularly relished by rats, and barium carbonate, being odourless and tasteless, can be used with almost certain and deadly effect by placing about two grains of the powder in the body cavity of any of these insects. Small doses of barium carbonate are not fatal to human beings or domestic animals, and it can, therefore, be used with relative safety in and near dwellings; safety precautions, however, should always be taken.

A useful method of capturing dragon flies is to smear small twigs with the latex of the jack fruit tree, and place them at the edges of water holes and streams frequented by the insects.

In preparing baits it is always advisable to smear the hands with an essential oil e.g. oil of aniseed, to mask the human smell.

It is interesting to note that poison baits, for which no general success was claimed under the initial scheme, enjoyed an almost immediate popularity. During the period June—December 1931, 18,022 pounds of poison balls were distributed; this represents approximately 18,,022,000 poison baits, each containing 0.696 grains of sodium arsenite. It has been suggested that under the caudal payment system, poison was not extensively used because rats poisoned by one cultivator would probably go to another owner's land to die.

The distribution of poison is well organised. The *Ketua* of a unit area is supplied direct from the manufactory: in addition, the Malay Assistants are responsible for distribution in native homesteads, and also have a poison stall at all village fairs where material is issued to those requiring it.

Traps.

Steel Traps. Early observations indicated that good results could be obtained by using a cheap imported type of steel break-back trap, which could be obtained in cases of twenty-five dozen, at eighty-five cents per dozen. Under field conditions, these traps require constant care and attention to prevent them from becoming rusty and consequently going out of order; while in addition, they need daily visits for re-setting and baiting. They are, however, largely used on Padi Test Plots and Stations in Perak, and give very satisfactory results.

As with poison, the human smell should be masked when handling traps, and this can be done economically and effectively by smearing the hands with mud, or holding them over the smoke of a small grass fire.

A large variety of baits may be employed, the most effective being padi, dried fish or prawns, tapioca root, coconut meat—preferably heated over a fire before use—and the insects mentioned in connexion with barium carbonate. One disadvantage of using padi as a bait is that the trap is often sprung by birds.

During 1931, 23,860 steel traps were distributed to cultivators in Krian, but it was observed that these were not used to nearly the same extent as previously, and it can only be presumed that this was due to the trouble of baiting, resetting and maintenance, coupled with the cessation of tail-money. The free supply of these traps has now been discontinued, and endeavours have been made to popularise simple home-made contrivances which can be constructed by the cultivators themselves at very little cost, and which are efficient and require little attention.

Deadfall—The deadfall trap was advocated by the Department of Agriculture in 1921 and two simple forms of deadfall trap which can be made at small expense are now largely in use. One known as *perangkap timpa* employs a flat board weighted with a big clod of earth and supported by a small wooden pin; which is connected to a trip mechanism situated near the bait. A slight movement of the mechanism causes the wood to fall upon the victim. Another form known as *kuching tuli* or *kuching pekak*, embodying a similar principle, is made in the form of a narrow trough for use in runs; in this case a heavy block of wood is released as soon as the trip is operated.

Bamboo—a very simple method of catching rats, and one that should have a large appeal to the padi cultivator since it does not require setting and needs very little attention, consists of a length of bamboo about four feet long, with all the nodes removed. The diameter should be big enough to allow a large rat to enter. The bamboos are concealed in the undergrowth or along runs therein, in such a manner that one end is invitingly displayed in the direction from which rats may be expected to come for cover after a nocturnal forage. It appears that rats will readily take cover in a well-placed bamboo, providing it has been thoroughly dried before use, and remain there much the same as in their own tunnels.

The traps are tested for a catch by simultaneously closing both ends with a handful of grass and shaking: the rodent may be disposed of by submerging the bamboo in an adjacent drain; a more popular diversion is to the club the animal to death as it is shaken from one end. As snakes are sometimes found in this form of trap, care should be observed in the method of despatch. Bamboos have the advantage of not being limited in their effective capacity, for more than one rat may be caught at a time.

Bamboos tried over a small area gave very satisfactory results, and the method is now being extended to test its possibilities on a large scale.

Ratfast—an adhesive preparation manufactured by Mr. Parker of Bagan Serai, was tried under field conditions. The material is placed in shallow trays with a bait in the centre. On exposure in the field it was found that the viscosity was affected by changes of temperature, and if the trays were not carefully placed the material was lost. No suitable technique for field use was evolved. Where shelter is afforded, however, as in houses and stores, ratfast can be used with excellent results.

Control Effect on Sex Ratio.

With a view to ascertaining whether any measure of control exerted an influence on the sex ratio of the rodent, an examination of rats killed by trapping and poisoning over a period of several months disclosed the following :—

Traps.		Poison.	
Males	Females.	Males	Females.
36,193	54,601	29,812	38,892

It would appear that both trapping and poisoning tend to displace the ratio in the direction most suitable for assisting in efficient control.

Species of Rats.

A large number of rats caught in the field have been submitted from time to time to the Institute for Medical Research, Kuala Lumpur, and Raffles Museum, Singapore, where identifications have been kindly undertaken. Some of the species, however, have not yet been definitely determined.

Based on information received and observations on specimens obtained, the Agricultural Field Officer, Krian, Mr. R. G. Heath, puts forward the following classification of rats of economic importance in the Krian district :—

1. *Rattus Norvegicus,* Malay *Tikus Mundok.*

The English brown or wharf rat, a very large animal with whitish feet and tail. Common in coastal areas in the vicinity of dwellings.

2. *Rattus rattus jalorensis.*

An indigenous, white-bellied jungle animal, tail rather longer than head and body combined; teats, 2 pairs pectoral, 3 pairs inguinal.

3. *Rattus rattus diardi.*

The "Commensal" dark-bellied form, frequenting homesteads, very similar to *jalorensis* in build, but underparts range from drab to chestnut.

4. *Rattus rattus argentiventer.*

The common rice field rat, tail normally shorter than head and body combined. Teats, 3 pairs pectoral, 3 pairs inguinal.

The Malay *tikus ladang* appears to embrace 2, 3 and 4 above.

It is not possible, at present, to indicate to what extent the species described above are responsible for damage in rice fields. It is of interest to note, how-

ever, that *Rattus rattus argentiventer* is the species most commonly met with in the open rice fields in Krian, while *Rattus norvegicus* and *Rattus rattus diardi* are localised—the former in the coastal area, and the latter in the inland districts of Selinsing and Gunong Semanggol. There is no concrete evidence that *Rattus rattus jalorensis* is a pest of padi although it is extremely likely that it is.

Although there is a definite movement of rats during the year, migration is not pronounced owing, no doubt, to the very mixed nature of the cultivation in the District, both within and without the rice-growing areas, and also to the presence of dwellings and towns, together with industries such as fish-preserving, poultry-raising and rice-milling, from which sources an adequate supply of food is available.

In the rice fields, a pronounced increase is evident following planting, and would appear to culminate after harvest. Damage to nurseries is, as a rule, only slight, and the main crop is not seriously attacked till it has become well established, when the succulent stalks are gnawed through near ground level, usually some distance from a bund, *batas* or other centre of rodent concentration. As the crop develops towards maturity, depredations increase in severity. At this stage there appears to exist a marked association between water supply and rat damage, as an excess of water is invariably accompanied by increased damage, possibly due to the facility thus afforded for reaching the ears; similar results are experienced if water is insufficient.

The appearance of a rice crop damaged by rats is very characteristic. In any plot where depredations occur, the damage is invariably confined to the centre; even in bad attacks, where the affected crop presents the appearance of having been trampled by heavy animals, the perimeter, especially if adjoining *batas*, is rarely even touched. The only reason that can be adduced for this systematic method of attack is that the crop which escapes attention forms a screen to shelter the rats and to hide the holes and runs in the *batas*.

Runs and tunnels are constructed on the banks of distributaries and drains, but these would appear to be used mainly for purposes of shelter and protection. During the breeding season, which extends from harvest (February) to about July, burrows are made in the dry grass bunds, and in these the young are produced. Undergrowth or accumulations of vegetable material may also be used to accommodate nests.

Breeding would appear to be extremely intensive and as many as eighteen young rats have been found in a nest. On one occasion, two nests were discovered side by side each occupied by a female nurturing two litters, one at teat and one just old enough to break for cover. The total of both nests amounted to fifty-six rats.

AGRICULTURE IN TRENGGANU

BY

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The following notes are abstracted from a fuller report on a tour which the writer made to Trengganu, at the request of the Government of that State, to report on agricultural conditions and to formulate proposals for agricultural development in Trengganu.

The writer takes this opportunity of thanking all officers in Trengganu with whom he came in contact, for their kindness and hospitality and for their help throughout the visit.

Trengganu is divided into four Administrative areas, their boundaries following the water-sheds and for the purpose of description it is most convenient to follow this arrangement.

The Jajahan Barat, comprising the two northern districts of Besut and Setiu, is drained by rivers of those names and forms a large coastal plain which varies in width from about three to twelve miles. In the north west, this plain is abruptly bounded by high precipitous hills, but over the greatest length of the district the plain runs into quartzite foot hills which in turn lead to mountainous country. The soils of this plain follow closely those found elsewhere on the east coast—namely, a high coastal bank of practically barren sand extending inwards from the sea for distances up to three or four miles, behind this sand a comparatively narrow belt of deep swampy organic soil from which a heavy alluvial loam stretches back to the foothills in the vicinity of which the soils become lighter in nature and contain a considerable amount of gravel and sand.

The Kuala Trengganu district is drained by the Trengganu river and its tributary the Nerus. The sequence in soils from the coast is similar to that found in Besut except that both sand and deep organic belts are narrower, the latter in places being absent. In this district also there is a very extensive plain, the soils of which vary more than those in Besut in that there is a considerable quantity of light-coloured clay or heavy loam in addition to the predominant alluvium. The soils of the undulating and hilly country on the western margin of this plain are of a coarse and easily washed character.

The Jajahan Timor is, in effect, an immense plain broken up by three low ridges of hills running roughly north and south. Between the sea and the first range only the coastal sand and organic soil types are found but beyond this, good alluvial and other light-coloured clay and loamy soils are found. In the vicinity of the Kemaman River, undulating land approaches rather more closely

to the coast than elsewhere and this soil is somewhat coarse and sandy. In the vicinity of Kemaman also there appears to be a greater proportion of the organic type than elsewhere.

Treated as a whole, the State comprises four main soil divisions: the coastal sandy strip of little or no agricultural value; the deep swampy region immediately behind the coast; the immense plains of loamy soil which merge into undulating country and foothills of a coarse nature.

The area of the State is computed as 5,000 square miles and the population in 1931 proved to be 179,000 persons. This population is, however, not distributed throughout the State, but is concentrated on the coast line, in Kuala Trengganu District and in the vicinity of the Besut river.

Agricultural development in other parts of the State is negligible and the little that has taken place is confined to narrow disjointed strips of river bank cultivation, for the people are primarily fishermen and little interested in agriculture, though in this connection it is probable that the barren coastal sand bank has formed a barrier discouraging them from penetrating inland or turning to agricultural pursuits.

The standard of knowledge on agricultural subjects and everyday procedure is, for a country population, surprisingly small, the people having no idea of adapting procedure to conditions and no knowledge of the varieties of rice or the cultivation of alternative crops. The people appear to be receptive of what were to them new ideas and are prepared to put those at least to the test.

Padi.

Four types of padi are cultivated in the State namely—

(1) Padi chedongan — Wet transplanted padi.
(2) Padi taboran — Padi broadcast on dry land.
(3) Padi tugalan — Padi dibbled in on dry land.
(4) Padi huma — Padi dibbled in on burnt off jungle land which is subsequently allowed to grow up in jungle.

The cultivation of wet padi in large areas is confined to Besut and Kuala Trengganu Districts. A few small native-built irrigation dams have been constructed though, for the most part, the crop depends for water on rainfall and the yield, therefore, fluctuates from year to year. In both of these localities the crop appears to be well cultivated and cared for. In other districts, cultivation of wet padi is confined to small and isolated blocks in which there is a marked lack of collective effort and only a slight understanding of pest control. In certain areas the most elementary principles of cultivation and water control are not understood.

Padi tugalan, on the lines of the Kelantan dry padi, is not extensively planted and though a few well-cultivated plots are seen, the principles underlying the cultivation of this crop are not generally understood so that correct procedure is often a matter of luck and the crop more variable than should normally be the case.

Padi taboran is grown on land suited to padi tugal and is planted either because the owner knows no alternative form of cultivation, or because he has too much land to plant and care for by the superior tugal method. After three ploughings and harrowings, the seed is broadcast and harrowed in and thereafter the crop is left to itself. Weeding is impossible and the padi becomes wholly or partially choked with grass. Seeding is too close to allow plants to develop properly and a great waste of seed occurs. This is an exceedingly wasteful form of cultivation from every point of view, but particularly in relation to land which is planted for two years and fallowed for one or two season the crop at its best can only be a partial success and can never be economic.

Padi huma is grown extensively throughout the State, but especially so in the Jajahan Timor and Ulu Trengganu. One is struck by the lack of primary jungle which is attributed to this wasteful form of cultivation. The jungle is felled and burnt off after which either one or two crops of padi are removed, the land then being allowed to grow up in secondary jungle and the cultivator moving to a fresh site.

Varieties of padi.

As might be expected, a number of the varieties grown in Besut are the same as those planted in Kelantan and the same applies to a lesser extent to Kuala Trengganu, but a fact which must have a very great effect in diminishing yields is that a large number of cultivators make no differentiation between types of padi and use the same variety on wet and dry fields. Whether this is due to the loss of types through careless storage of seed and mixing until seed gives the same yield under either condition, or whether it is due to some major calamity in the past wiping out the dry types is not clear. As might be expected under the circumstances, cultivators—even in the more advanced areas—have no ideas as to the best varieties for any particular soil type and it is probable that, even in Besut and Kuala Trengganu areas, varieties are so mixed as to mask completely differences in yield. The determination of the most suitable varieties of wet and dry types and the maintenance and distribution of these varieties is work of primary importance.

Rubber.

Rubber holdings seen throughout the State are, for the greater part, under a heavy cover of undergrowth bordering on forest conditions, though in this matter again Kuala Trengganu is superior to other localities. Tapping generally is of a low standard, but the quality of rubber produced is exceedingly high for small-holding produce and is definitely superior to Malay small-holders' sheet in the writer's experience of the Federated Malay States. The sheet seen in Paka Chukai and Kuala Trengganu was cleanly prepared and well cured by smoking. In Paka it was stated that hand rollers were either owned individually or by groups of three and four small-holders; the same remark applies to the small smoke-sheds seen which are constructed of roughly-squared timber

with walls of bark collected in the jungle, the fires being external and the smoke led into the sheds through hollowed-out tree trunks. Besut is the only district in which block rubber uncured and full of water, sand, bark and other impurities is prepared. The increase in export duty to the same figure as that for sheet, or the establishment of a diminishing quota system for this type of rubber would raise the quality and bring more money into the State.

Coconuts.

Extensive cultivation of this crop is confined to the sandy coastal belt, though one European-owned estate, which was not visited, exists near Kretir. Palms, except in thickly populated areas, have a somewhat unhealthy appearance and produce small yields. The copra produced, at least during the wet season, is of a low grade, the owners of holdings having no idea of adequate curing, or of the construction of kilns to effect this. The conditions pertaining to small yields and small holdings owned by fishermen point to the need for the adoption of co-operative kilns, but in this as in other things, education in market requirements, nut harvest and manufacture—which cannot at present be given—are urgently required.

Arecanut and Gambier.

These two products to the value of $112,000 and $42,000 respectively, were exported from the State during 1932. Arecanut normally occurs as a casual *kampong* crop and not in large defined areas. The nut is exported in both smoked-cured and sun-dried forms. No gambier holdings were inspected. Considerable areas of land suitable for one or other of these crops are available in Dungun and Besut.

Tobacco.

Cultivation of this crop has increased considerably in the last two years. Individual holdings are small though one estate of 10 acres owned by a Sumatran Malay has come into being at Batu Hampar. Small-holders' leaf is sun-dried and sold to local Chinese dealers who sort, press and chop the leaf and produce a type of tobacco popular among native consumers by treatment with groundnut oil and rouge.

Other crops.

The writer was impressed by the absence of crops other than those mentioned above; bananas and other fruit, tubers, beans and vegetables of all kinds appear to occupy the lowest place in the economic life of the *kampong*. The difficulty in obtaining a variety of planting material is obvious, and was mentioned by both raiats and school teachers.

School Gardens.

The only Government Schools visited were those in the Jajahan Timor, the gardens in all cases being situated on the coastal sand which makes the

raising of good crops difficult. In Kemaman and Paka, fair attempts at cultivation have been made, but there was a marked lack of variety in crops grown while lay out and cultivation were generally poor.

Stock.

The State carries an animal population estimated at 20,000 buffaloes, 23,000 cattle and 228,000 poultry as well as sheep, goats and pigs.

The greatest number of cattle and buffaloes are found in Besut and Kuala Trengganu Districts. The cattle are of the small Siamese type and are used entirely for draught purposes. In Besut, the animals are in much better condition than those in Kuala Trengganu, as in the latter District no adequate grazing is available. Hens and ducks are of good average quality and it is surprising that exports are only in the region of 500 head per annum. The organisation of groups of peasants to ship poultry to Singapore would give the people extra money and encourage breeding of poultry.

Epidemic poultry diseases are said to be common, but these can only be overcome by education in feeding, housing and general sanitation and the provision of veterinary facilities.

The very backward state of agriculture in Trengganu is attributed to a number of causes among which stands the nature and the sparsity of the population. As has been remarked before, the people are primarily fishermen and have little knowledge of agricultural practice. Except in Besut and Kuala Trengganu Districts, cultivated areas are small and isolated; this fact in itself makes for serious diminution of yields of all crops, owing to the depredations of pests and unless long distances to a centre are to be covered, reduces the available market to a few individuals. The peasant, therefore, tends to cater only for his own needs, produces no money crops and is unable to make purchases from the outside world or to pay land rent.

Trengganu with its huge areas of well-watered and unopened plain, has immense agricultural possibilities the adequate utilisation of which are of prime importance not only to the State but to Malaya as a whole. The lie of the land and the types of soil render the country suited to the cultivation of padi and a large variety of other food crops which would tend greatly to reduce the reliance of the Peninsula on imported supplies, but in this connexion it must be stressed that if it is the policy of the Government to convert the State into a rice-exporting country, it will be necessary to spend considerable sums of money on irrigation, for though dry padi will supply the food of the peasant it is seldom that this type will produce a saleable surplus. The country is one which in view of the nature of the land and the large number of rivers, appears to the layman to be ideally suited to irrigation. The provision of controlled water would, in addition to ensuring the padi crop, greatly increase the productivity of the land in other crops during the dry season.

Concurrent with the necessity for irrigation in a policy concentrating on rice production goes the need for milling facilities to provide a market for the crop. In view of the reliance on rainfall for irrigation water and the possibility of growing other crops during the dry season, the trial of certain heavy-yielding short term varieties of padi from the Pulau Gadong Station in Malacca would be valuable.

In the normal course of events, cultivation must for a large number of years be confined to the plains occurring throughout the State and on these a system of dual cropping—padi followed by a short term crop during the dry season—should be encouraged. The actual crops most suited to conditions are a subject for experiment, but until this has been established, tobacco, ground-nuts, loofah, cucumber, brinjal, chillies and cow-pea and possibly soya bean are suggested as suitable crops. In localities where large holdings of dry land result in the cultivation of padi taboran it would, for the present, be in the interests of the State to encourage peasants to adopt the *tugal* system of cultivation on a smaller area and plant the remainder of their land with either long- or short-term food crops.

The efficient cultivation of available land and the development of potential land on the lines indicated, by people having such a rudimentary agricultural knowledge, is impossible and unless provision can be made for Agricultural Services to educate the peasantry and carry out experiment and demonstration work, waste of land and the loss of very great potential supplies to the whole country will result.

THE CO-OPERATIVE MARKETING OF EGGS IN MALAYA

BY

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It is a matter for surprise that in Malaya, which is predominantly an agricultural country, it should be found necessary to import large quantities of poultry and eggs; but such is the case, and from the figures given below it will be appreciated that the imports are on a considerable scale.

Net Imports into Malaya of Poultry & Eggs.

Year	Poultry, Alive		Poultry, Dead		Eggs, Fresh & Salted		Total value Poultry & Eggs $
	Quantity No.	Value $	Quantity Tons	Value $	Quantity per 100	Value $	
1930	1,120,972	1,011,720	89	124,309	488,185	1,249,369	2,385,398
1931	875,727	708,286	74	89,890	377,672	692,085	1,490,261
1932	930,597	611,685	37	43,608	170,733	293,305	948,598
1933	826,598	515,294	46	45,349	203,402	316,302	876,945

An investigation of conditions among the Malay poultry owners in the District of Krian, in which it was known that considerable numbers of poultry were kept, showed two factors which militated against the popularity of keeping poultry. In the first place, the flocks were liable to be decimated by disease and in the second place, the price paid for eggs to the poultry owners, who carried the risk of losing the birds in addition to the labour of looking after them and the expense of feeding them, was ridiculously low. The majority of the rayats were in the habit of selling their eggs to higglers, usually of Chinese nationality, who travelled round the kampongs and paid on an average about fourteen cents for ten eggs. The eggs eventually arrived in the markets and were then retailed at from twenty to thirty cents for ten.

This method of marketing is obviously most unsatisfactory, both from the point of view of the poultry owner and of the ultimate purchaser in the market. The price obtained by the seller is insufficient to encourage poultry-rearing on any scale while the egg, by the time it reaches the breakfast table, is almost inevitably stale.

A solution of the problem appeared to be possible by introducing among the rayats a method of marketing eggs on co-operative lines and efforts were made in March and April 1932 to interest the members of the Tebok Haji Musa Rural Co-operative Credit Society in a co-operative scheme and to find a market for their eggs. The first order obtained was from the Runnymede Hotel, Penang, and a regular supply to this Hotel has been maintained ever since.

There are, of course, on the market most elaborate machines for grading and candling eggs, but naturally the use of any expensive apparatus of this kind is out of the question when working in a Malay *kampong* on a small scale and a simple method of candling and grading, which however proved in practice to be quite efficient, was evolved. The *modus operandi* adopted by the Society was for the eggs to be brought in daily to a collecting station by the individual members and, after being graded to eliminate small ones, they were candled to ascertain whether they were new laid. Those which passed these tests were then "chopped" with a rubber stamp "Co-operative Poultry Products" and the member credited with the number of eggs accepted. For packing purposes it was found that the small wooden cases used for importing tins of condensed milk were procurable at about six cents each and, after a few trials, it was decided that a case would hold 200 eggs with reasonable security from damage. Fortunately, as Krian is a padi-growing District, there is always plenty of padi husk available and this was found to be an excellent medium for packing. After the business had been carried on for a few months, suspicion arose that consignments were being tampered with and to overcome this difficulty the cases were bound with wire and the wire sealed before despatch from the Society.

This experiment having worked satisfactorily for a few months, it was decided to extend the scope of the operations and an Agent was found who was willing to open a stall in the Kuala Lumpur Market and to make house to house deliveries. In order to maintain the supply, three more Rural Credit Societies in Krian were brought into the scheme in September 1932. During October and November, supplies were despatched to the General Hospital, Singapore, but this order was, for various reasons, terminated and it was decided to concentrate on supplies to marketing centres nearer to Krian than Singapore.

At the outset, each Society worked individually, but in November 1932 it was arranged that a Union of the four should be formed and a flat rate paid to the members as the Societies which were fulfilling the least lucrative orders naturally regarded it as a hardship that the net price obtained should vary in the different Societies. It was found impossible to fix a standard price for all orders, as market prices varied in the different centres which were being supplied and the prices paid to the Societies had necessarily to be varied in order to compete with the local dealers. No attempt was made to undersell the local dealers and the prices charged were if anything slightly higher, the Societies relying upon selling an egg of a fairly standard size and, moreover, of a guaranteed freshness.

In order to reduce the time from the *kampong* to the consumer it was decided that consignments should be sent by passenger train, although this entailed a greater expenditure upon freight and a reduction of the net profits. The usual course in the case of consignments to Kuala Lumpur is for the eggs to be collected in the morning in Krian, examined for cleanliness, graded, candled, stamped and packed and finally despatched by the night mail to Kuala Lumpur. They are collected by the Kuala Lumpur Agent at 6.30 a.m. and as a general rule, are disposed of the same morning so that there is no reason why they should not be available for the breakfast table less than 12 hours after leaving Parit Buntar Railway Station.

In the year 1932, the four Societies concerned sold 143,000 eggs and realised thereby $3,520. The following year an Agent was found who was willing to sell the Societies' eggs in Ipoh and a regular order was obtained from St. Margaret's School, Fraser's Hill. During the year, the Societies engaged in this business sold 278,430 eggs and the average net price paid to the members throughout the year, after deducting all expenses, amounted to $1.92 per hundred, which must be considered satisfactory, as the average price per hundred which would have been paid by the higglers would have been in the neighbourhood of $1.40 only. In addition, the business gave permanent employment to five Malays.

There is no doubt that the members of the Societies engaged in the co-operative marketing of eggs are fully alive to the benefits which have been derived from the business and when, during temporary scarcities of eggs, the higglers offered higher prices they remained loyal to the Societies and maintained their regular supplies.

The only serious criticism, so far, has been that the average size of the eggs is small. The blame for this lies with the poultry and not the co-operators and now that those concerned realise that there is a reasonable profit to be made by the marketing of eggs on co-operative lines, the improvement of the breed and an increase in the number of poultry kept in the kampongs should follow as a natural corollary.

FISH PRODUCTION IN THE KRIAN IRRIGATION AREA

BY

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Fish production constitutes an industry of some economic importance in many parts of the Krian irrigation area. It is an industry intimately bound up with padi cultivation and one that provides a valuable source of revenue for the Malay cultivator, additional to that which he receives from his padi crop.

The fisheries depend entirely on air-breathing fishes belonging to one or other of the following families :—

(1) Anabantidae
(2) Ophiocephalidae
(3) Siluridae.

Of the fishes commonly met with, the "sepat" ("sepat Siam" and "sepat padi") together with the "puyu" (climbing perch) belong to the first, the "aruan" (murrel or serpent heads) to the second and the "keli" (catfishes) to the third group.

The most important fish is the "sepat Siam" or "sepat benua" (*Tricopodus leeri*). This fish was introduced into the mukims of Bagan Tiang and Tanjong Piandang some years ago and has since spread throughout the district.

The "sepat Siam" is an extremely hardy fish, a prolific breeder and of high value as a food owing to it's oily character. The fact that it is air-breathing makes it easy to transport; this feature, combined with it's breeding habits, renders it possible rapidly to populate a new area by introducing merely a few pairs of the fish.

Among the Malay cultivators, there are many who dislike "sepat Siam". They insist that it is an extremely pugnacious fish and drives away good fish like "aruan" of which they are extremely fond. This may or may not be the case; but primarily, it is a vegetable and silt feeder, preferring to grub around the roots and stems of the padi and other plants seeking a mixed diet of algae and infusoria.

During the padi season, the "sepat Siam" are caught in the padi fields, irrigation canals, drains and other water courses. Catches are heavy during rainy weather. Following a heavy storm, many people can be seen at work with cast nets (M. jala), lift nets (M. tangkol) and rods reaping the benefit of the washing into the drains of large quantities of fish of all kinds, more particularly of "sepat". It is said that on occasions of this kind, cultivators may catch, in one morning, fish to the value of from 50 cents to $2.

A very common method of capturing "sepat Siam" in Krian is by means of wells (M. telaga) in the padi fields. These wells vary in size. In the coastal mukims, 30 ft. x 20 ft. is a common size and there is normally only one well

to each Lot of approximately 5 acres of land; whereas in central and south Krian the wells are usually much smaller, and there may be two or more to each Lot. The wells are dug in the lowest portions of the padi fields so that they retain water even when the rest of the field is dry. Coconut palms are often planted around the edges of the wells to provide shade. The fish breed in the wells, spreading over the fields after irrigation has taken place. They are caught in the fields, largely by means of rods, during the growing period of the padi. When the padi is ripening and the water is being run off the fields, the fish collect in the wells. The wells are then bailed out and all the fish are taken except a few, which are retained for the next season's breeding. Many small water courses, such as exist around house sites, are similarly cleared. The bulk of the catches from wells usually consist of "sepat Siam". Most of the "sepat Siam" caught by the Malay cultivators are sold fresh to Chinese dealers at a price varying from $1 to $4 per pikul. The Chinese behead and gut the fish which are then salted and sundried. From 2½ to 3 pikuls of fresh "sepat Siam" are required to prepare 1 pikul of the salted and dried product. Considerable quantities of salted "sepat Siam" are exported to Sumatra and Java as well as sold in the local markets.

Yields of fish taken from wells vary considerably. It is said that some wells are capable of producing a return of as much as $70 per annum, but a more usual figure would be from $10 to $40 per annum. The heaviest yields are recorded in the coastal mukims. The following figures taken from Kuala Kurau in April 1932 give some idea as to the yields attainable: —

Size of well		*Yield of fish in kati*
18 ft. x 32 ft. x 6 ft.	...	500
19 ft. x 29 ft. x 6 ft.	...	1100
20 ft. x 32 ft. x 6 ft.	...	600
21 ft. x 30 ft. x 6 ft.	...	2800
18 ft. x 30 ft. x 6 ft.	...	280
22 ft. x 32 ft. x 6 ft.	...	1300
20 ft. x 30 ft. x 6 ft.	...	400
22 ft. x 32 ft. x 6 ft.	...	900
20 ft. x 30 ft. x 6 ft.	...	300
21 ft. x 32 ft. x 6 ft.	...	900

A small well at Titi Serong Experiment Station, size 24 ft. x 24 ft. x 6 ft. yielded in January 1934, 200 kati "sepat Siam", 50 kati "aruan" and 100 kati "keli". Taking the prices ruling at the time of 2 cents per kati for "sepat Siam", 5 cents per kati for "aruan" and 3 cents per kati for "keli", the value of the catch works out at $9.50. In 1932, an irrigation drain at Kuala Kurau 360 ft. long, 8 ft. wide and 6 ft. deep, yielded 16,000 kati of fish.

Associated with the "sepat Siam" is a smaller species known as "sepat padi", "sepat jawi" or "sepat ronggeng" (*Tricopodus trichopterus*). This species seldom exceeds 3 to 4 inches in length as compared with the 7 to 8 inches

of "sepat Siam". Carrying, as it does, a very small amount of flesh, it is of little value as a food.

Next in importance to "sepat Siam" are the fishes belonging to the genus Ophiocephalus and known collectively as "aruan". These are predatory fish and feed largely on frogs and small fish other than "sepat" and "keli". They breed largely in shallow water, often among the grasses and weeds alongside the division ridges of the padi fields. They are capable of travelling overland and can bore through the division ridges of fields in cases of necessity. They grow to a fair size and, when full grown, may weigh from ½ to 1½ kati. They are caught by means of rods or sometimes with long poles baited with dead frogs. They are also found in wells, although "sepat Siam" provides the bulk of the catches taken in that way. Only occasionally are "aruan" captured in traps. The Malays sell the greater part of their catches of "aruan" to the Chinese, but preserve a certain amount for their own use by salting or pickling (M. pekasam). "Aruan" transport well and are sold alive in the markets of large towns at a retail price of from 10 to 16 cents per kati. The local dealers purchase "aruan" from the Malays at prices from 4 to 10 cents per kati.

Third in importance are the "keli' or catfishes (Clarias sp). These fishes are omnivorous, they feed largely on excrement, but it is doubtful whether, under the Krian conditions, they can obtain sufficient to make it an important article of diet. They also devour frogs, frog spawn, larval insects and small fishes. They are furnished with special accessory organs of respiration and can travel overland, sometimes for considerable distances; they are also able to bury themselves in the mud and survive for a considerable period without water. They are prolific breeders. They are caught mainly in traps in the padi fields, but are also met with to some extent in the wells. Not all Malays appreciate the "keli" as food, but a proportion of the catch is usually salted or pickled and preserved by them, the remainder being sold fresh to Chinese dealers. They transport well and are sold alive in the markets of the large towns. The local dealers purchase "keli" from the Malays at prices from 4 to 7 cents per kati.

The "puyu" (*Anabas scandens*) belongs to the same family as the "sepat". It grows in some cases to a size of 6 to 7 inches and is very much relished as food by Malays. It feeds largely on moss and lichens. It is not so commonly met with as "sepat", "aruan" or "keli" and is mainly caught in traps. The bulk of the catches are not sold, but are retained by the Malays for pickling and preserving to tide them over the dry season.

All the species of fish mentioned above flourish in the padi fields of the Krian irrigation area. They bring to the Malay population of the District, more particularly in the coastal mukims, a useful item of revenue additional to that derived from their padi crop. In some cases, the value of the fish produced is said to be worth as much to the cultivator as is his surplus rice crop. In the majority of cases, fishing provides him with the means of paying his land

rent and water rate. It is a source of income requiring but little exertion to obtain and one that might well be adopted by the Malay cultivator in other parts of the country where conditions are suitable for the purpose.

It is, unfortunately, impossible to obtain full data relative to the exports from the district of fish caught in the padi fields of Krian. This is due to the fact that three of the four important varieties of fish caught, namely "aruan", "keli" and "puyu", are exported fresh and are not subject to any form of export duty. Figures supplied to the writer by the courtesy of the Superintendent of Customs, Krian give the exports of dried "sepat" from Krian district during the year 1933 as amounting to 2609 pikul 73 kati, the bulk of which went to Penang. These figures do not by any means represent the true state of affairs, however, as a large part of the catch is transported, in a fresh condition, over the boundary into Province Wellesley, there to be salted and sundried.

The Fisheries Officer reports that from six Chinese dealers in 4 centres 6,500 piculs (382 tons) of fish were exported in 1933 to Singapore and Penang.

The Malays of Krian district take little or no part in the marketing of the fish captured by them. Taking into account that salted and sundried "sepat Siam" is retailed in the towns at a price of 20 to 22 cents per kati whereas the fresh fish is sold by the Malays to Chinese dealers at 1 to 4 cents per kati (2½ to 3 kati "sepat Siam" will give 1 kati of the salted and sundried product), it seems surprising that the Malays do not make an effort to perform the salting, sundrying and marketing operations themselves. There would seem to exist a definite scope for the introduction of some form of co-operative preparation and marketing as regards the production and sale of "sepat Siam" in Krian District. The same remarks are applicable to the marketing of fresh fish such as "aruan" and "keli". The main drawback to the initiation of co-operative methods seems to be lack of capital on the part of the Malay producers. The capital required to initiate such methods would be large, inasmuch as the Malays would require prompt payment in cash for fish supplied.

In conclusion, the writer wishes to express his gratitude to Mr. W. Birtwistle, Officer-in-charge, Fisheries Department, S.S. and F.M.S. for the very considerable amount of information and assistance rendered by him in connexion with the preparation of this article.

Note.—1 kati = 1⅓ lb. 1 picul = 100 kati.

Abstract.

PAPAYA AND PAPAIN. *

General Information.

The papaya or papaw is a fruit tree widely diffused throughout tropical regions. It has attracted attention because of the papain contained in the whitish latex of the the stems, leaves and rind of the fruit, containing an enzyme by means of which albuminoids may be dissolved and digested, so that it serves the same purpose as pepsin.

The exports of papain from Ceylon have increased considerably in recent years. The exports from that country in 1932 amounted to 64,356 lbs., valued at Rs. 338,247. Of this quantity, 16,022 lbs. were consigned to the United Kingdom and 45,575 lbs. to the United States of America. The total imports of papaw juice or crude papain into the U.S.A. in 1932 were 54,491 lbs.: 80 per cent. of these were from Ceylon.

Little is known of the trade channels followed by the powders imported into the different countries, so that no information can be given as to the requirements of the markets and it would be inadvisable to encourage the cultivation of the papaya tree and the extension of the papain industry, although, in certain tropical regions, it might attain some degree of importance. Under present conditions, planters could be advised to take up papaya growing only if they were assured of a market for their products.

Distribution of the Sexes.

The papaya tree is generally described as being dioecious,† but this is not true of all varieties. The only question of interest for growers is the possibility of being able to determine the sex of the young plants, or of the seeds. There is at present no evidence that this can be done; there remains, therefore, only one method of eliminating the possibility of rearing too many useless male trees; namely, to put several plants in each hole when planting—four plants per hole is recommended.

Cultivated Varieties.

Papayas vary considerably in appearance, but it is observed that the habits of the trees, as well as the shape, colour and aroma of the fruit, are much influenced by the conditions under which they are grown; as for example, sun, temperature, humidity, aspect. There are also certain hereditary characteristics. As cross-fertilisation is not easily avoided there must always be undesirable types amongst the descendants of trees which are not isolated. Consequently, it is advisable to establish small and isolated plantations of superior trees, for the sole purpose of seed production.

* Abstracted from an article by W. Bally in the *International Review of Agriculture* Year XXIV No. 11, November 1933.

† Having the male and female flowers on separate plants.

Establishment of a Plantation.

Papayas are generally reproduced by seed. Fresh seeds germinate in from 10 to 50 days; the rate of germination depending upon the degree of exposure to light. The best results are obtained if the seedbeds are exposed to the sun from 7 to 11.30 a.m. and shaded during the afternoon.

The seeds are sown in shallow trays or in the ground and carefully covered with a thin layer of sand. The plants should be transplanted at the end of three or four weeks. Another method of planting consists in placing from 4 to 6 seeds in a bamboo basket which, after germination has taken place, can be put in the final position in the field. It is advisable to cut off about 3 to 4 leaves before each transplantation, in order to avoid excessive transpiration. It appears that even plants which have attained a height of 2 metres may still be transplanted. It is possible, therefore, to replace male by female trees, even at an advanced age.

Many attempts have been made to reproduce papayas by vegetative methods. Though a certain measure of success has been attained in individual cases, the conclusion is reached that none of these methods has any practical value.

The usual spacing of trees is at a distance of about 7 feet each way.

The use of fertilisers is very generally recognised. The tree is most susceptible to potash and phosphate deficiency. It is important that careful research should precede manuring in order to determine the fertilizer requirements for the particular region.

Topping of trees has been advocated, but its advantages are uncertain.

There are certain advantages in intercalary crops. In British India tomatoes are chosen, but there are many other possibilities.

Opinions differ as to the age that a papaya plantation may attain. The yields of papain are most abundant during the first 3—4 years. It is advisable to replace the trees periodically so that the productive period of each tree never exceeds five years.

Diseases and Pests.

The diseases and pests by which the plant is attacked are not numerous and play an unimportant part. Papayas suffer from an excessively damp soil. The roots soon decay and the trees die shortly afterwards.

Papain and its Collection.

Papain is contained in the latex of the papaya. The characteristic properties of papaya latex were known as early as the 18th. century.

The latex tubes are found in all parts of the plant and the latex exudes whenever an incision is made; they are, however, most numerous in the outer skin of the fruit.

Many experiments have been carried out, from time to time, to discover the best methods of tapping the fruits. Earlier writers stated that the incisions

must be made with horn or ebonite knives and that the use of steel knives must especially be avoided as it tended to cause discoloration of the latex. These statements have been constantly repeated. The author, however, has tried steel knives and never observed any such discoloration of the latex. Preference should, in fact, be given to steel knives, as the edge is sharper and greater quantities of latex can thus be obtained. Pieces of broken glass can also be used. The latex can be collected in jars of aluminium, glass or porcelain.

The best results are always given by the first incision and, moreover, the papain coming from the first incision has the greatest proteolytic activity. Not more than four incisions should be made at a time on each fruit. Young fruits give small yields. The yields increase with the maturity of the fruit, attaining a maximum in fruits about three months old which have finished growing. All experiments indicate that the fruits should be tapped when at the age of 100 days and that two incisions should be made, returning every three days to the same fruit.

Preparation of Papain.

The most primitive process consists of spreading the latex on dishes and drying in the sun. The product so prepared will not have a satisfactory appearance; papain thus dried is brown or even blackish in colour.

Drying in furnaces, or in special sun-driers gives better results. The ideal preparation is, however, not obtained by these means for Hofstede has shewn in numerous experiments that drying *in vacuo* is the only method that makes it possible to obtain a product white in colour and with a proteolytic activity remaining intact even in alkaline media. For this reason in particular, prospective planters of papaya and manufacturers of papain are recommended to consult Hofstede's work.

Planters who intend to prepare their own product are accordingly advised to procure a plant for vacuum drying. A German model is described by the author, containing five shelves of 5 x 10 cm. spaced 6 cm. apart, by means of which about 2 kg. of dry papain can be prepared in about two hours only. The apparatus costs 2000 florins (Dutch) and to this must be added the cost of purchasing a dynamo for working the vacuum exhaust, amounting to about 500 florins; and further, there must be added the costs of packing and transport of the apparatus and the motor plant, including any customs charges, amounting to about 750 florins. This may seem a somewhat large outlay, but it guarantees the possibility of a regular supply of a product which, in practice, is certain to be appreciated by the purchasers.

The methods of papain purification are also described in the work of Hofstede; they are, however, too costly to be applied on the plantations and, as the crude papain always finds purchasers, the necessity for the manufacture of papayotine (refined papain) has not been experienced in tropical countries.

Yield.

Tapping of fruits may be begun ten to fourteen months after sowing. Lucrative yields can only be expected over a period of about three years. The different statements as to yield per tree or by acreage shew little correspondence. According to Hofstede's calculations, the yield per hectare amounts to 186 kg. in two and a half years if the trees are planted at distances of 4 m. x 4 m. apart, i.e. 625 trees per hectare, including 10 per cent. male plants; and to 300 kg. if the spacing employed is 3 m. x 3 m., or 1000 plants per hectare. The Principal of the Harcourt Butler Technological Institute at Cawnpore gives for the second season's tapping a yield of 28.7 lbs. per acre (32.1 kg. per ha.), and for another orchard 11.9 lbs. per acre (12.3 kg. per hectare), figures much lower than Hofstede's. The author estimates on the assumption of 250 trees per acre (617 trees per hectare) a production of 41.6 lbs. per acre, or 46.6 kg. per hectare.

Financial Return.

The price of papain on the New York market is taken as the basis of all calculations. In 1927 Ceylon papain was sold at 15.89 florins (Dutch) per kilo on the spot and it was as much as 17.40 florins in New York. The approximate range of prices in recent years, in shillings per lb. is as follows :—1925, 10 shillings; 1926, 18s.; 1927, 10s. 9d.; 1928, 16s.; beginning 1930, 7s. 6d.; end 1931, 10s. The latest quotation is given at 1.50 dollars to 1.60 dollars Gold per lb. (6.23 to 7.69 florins per kg.).

Hofstede has given estimates relating to an imaginary plantation of 13 hectares. On the assumption that such an undertaking may yield 2400 kg. of papain (which seems a generous estimate) and supposing that the factory possesses vacuum drying apparatus of improved type, Hofstede arrives at a cost price of 5.63 florins per kg. With the selling prices of 1927 there was thus a fair margin of profit. The profits resulting from the sale of fruits or products of the intercalary crops are not shewn on the balance sheet.

The estimates of the Cawnpore returns are of even more interest, since they are based on an actual example: a plantation of 2 acres which has been used as an experimental orchard. With the help of these data, compiled over three years, the author has established an estimate of the costs and profits of an imaginary plantation of 10 acres, carrying 250 trees to the acre. At the end of the second year the profit is 1216 rupees. In the total sum of the returns there figure :—(1) sale of the papain (416 lbs. at 12 rupees per lb.) producing 4992 rupees, (2) sale of the fruits, producing 3750 rupees.

The economic conditions in British India and Java are too diverse for comparison to be possible between these two estimates. It appears to be easy in Cawnpore to effect sale of the fruit; in Java there are difficulties, since the papaya is everywhere cultivated and there is always a great abundance of the fruit. In addition, in connexion with Cawnpore the sale of tomatoes is mentioned, producing 263 rupees in the first year of the trial plantation.

Uses of Papain.

In spite of increasing knowledge of papain, the number of purchasers remains limited. It appears that small consignments received regularly at Hamburg remain for some considerable time in the warehouses before finding purchasers. This is attributed to the fact that the proteolytic activity of papain is lower than that of the animal ferments. One authority in the trade states "Non-purified papain dissolves a quantity of albumin 200 times its own weight. Hence to digest 10,000 lbs. of albumin, 50 lbs. of papain would be required, while one lb. of pepsin is enough to produce the same effect, it should be added that the price of a lb. of papain is about 10s., while that of pepsin is about 2s."

On the other hand, reference may once more be made to the extent to which the importation of papain has developed in the United States. No information is available as to the uses in the United States, and hence all that can be done is to enumerate the various uses mentioned in publications consulted.

Reference is made to the use of the latex of the papaya for making tough meat tender. There would appear, however, to be limitations in this direction as it can only have this effect by direct contact.

Papain is used medicinally as a digestive to replace pepsin. Its use for this purpose, however, is limited by reason of comparative prices and also by the difficulty of obtaining papain in good condition which has preserved its full proteolytic activity.

Medicinally, papain has been employed in the combatting of cancer, diptheria and as a vermifuge.

Papain solutions have been used for reduction of fat and also as a substitute for rennet. It is certain that papain sometimes enters into the composition of chewing gum in America, which perhaps may be the explanation of the imports into the United States. It should be added that certain patent remedies contain papain and that it also enters into the composition of various milk flours.

The uses of papain are, in short, only very imperfectly known, but it is known that large quantities are imported into the United States of America.

Utilisation of the Fruit.

In certain cases the fruit may contribute something to the return from a plantation. The tapping of the fruit for the collection of the latex has no effect on the taste of the fruit.

The drying of the fruit has been suggested. It appears that the "flakes" thus prepared contain 10 per cent. of the moisture and 50 per cent. of the sugars and that vitamins of the ripe fruit are preserved if the drying is effected properly.

(Since the preparation of the above Abstract, our attention has been drawn to the latest number of the *Bulletin of the Imperial Institute*, Vol. XXXI, No. 4,

January 1934, in which there is a "Note on Preparation and Marketing of Papain." This article briefly states methods of tapping, yields, drying, packing, prices and grades of this product and gives a list of publications which deal with the subject.

It is stated that the price in December 1933 of average quality was 6s. 9d. per lb., and that oven-dried papain usually commands a premium of 3d. to 6d. per lb. over sun-dried.

The exports of papain from Ceylon in 1932 were 64,356 lbs. as compared with 76,947 lbs. in the previous year, 79,338 lbs. in 1930, 128,463 lbs. in 1929 and 125,684 lbs. in 1928. Of the 1932 exports, 45,575 lbs. went to the United States of America and 16,002 lbs. to the United Kingdom. The exports to the U.S.A. have steadily declined during the years under review; in 1928 they amounted to 111,877 lbs., while in 1932 they were 45,575 lbs. On the other hand, exports from Ceylon to the United Kingdom have slightly increased, being 11,054 in 1928 and 16,022 lbs. in 1932.—*Editor.*)

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Reviews.

Present Position of Agriculture in the West Indies.

being a "*Report by Mr. F. A. Stockdale, C.M.G., C.B.E., Agricultural Adviser to the Secretary of State for the Colonies, on his Visit to the West Indies, 1933*". 40 pp. Colonial Office, December 1933.

The title of this document is an insufficient statement of the subject matter. In his introductory paragraph the author states in reference to his tour—

> "An endeavour was made to acquire, so far as time permitted, a fair picture of the present position of agriculture in the West Indies and of the lines of development which were projected."

The Report is in fact, a concise review of the present position of agriculture in the West Indies.

Nearly half the Report records the matters dealt with by the West Indian Inter-Colonial Fruit and Vegetable Conference, 1933. As the findings of this Conference have been published in the March 1933 number of the *Malayan Agricultural Journal*, further comment in this place is unnecessary.

Reference is made to the West Indian Sea Island Cotton Conference 1933. This body decided on the formation of a West Indian Sea Island Cotton Association for the promotion and protection of the local cotton industry. The Association will be financed by a cess on lint exported. Further, the Conference allocated an agreed production of cotton in this area for the coming year in order to maintain prices by avoiding over-production.

The author also attended meetings of the Committee of the Central Cane-Breeding Station, Barbados. A brief review is given of the work of the Station and future possible developments are discussed.

A section of the Report is devoted to agricultural matters of special interest discussed in the course of the visit, from which one may gain an idea of the major problems affecting agricultural development, on which work is projected at the present time.

In conclusion, Mr. Stockdale states that sugar producers were reasonably optimistic in regard to the future and are obtaining increased production annually. Cocao producers generally were depressed and fear that unless conditions improve, forced sales of cacao properties are inevitable. Banana growers in Jamaica have suffered severely of late by reason of storms and floods, but knowing the recuperative powers of their Colony, are still optimistic in regard to the future; while an improvement in the Sea Island Cotton industry has aroused new hopes in the producers in those drier islands where this crop is the main stand by.

"The main problems which await solutions are those associated with the Panama disease of bananas in Jamaica and the witch-broom disease of cacao in Trinidad."

In view of the great importance of these crops to the Colonies in which they are grown, the need for scientific research, towards the solution of these problems, and unhampered by lack of finance, is emphasised.

D. H. G.

Banana Storage.

By C. W. Wardlaw and L. P. McGuire. H. M. Stationery Office, London. E.M.B. 72. 35 pp. 6 figs. Sept. 1933. Price 1s. net.

The investigation detailed in this interesting publication is a continuation of work prevously published by the same authors; *vide,* E.M.B. Reports Nos. 36 and 45. The present report is an account of recent investigations into the storage behaviour of several varieties of bananas, either well known in the West Indies or of hybrids evolved by the College Departments of Agriculture and Botany.

The Giant Governor, believed to be a tall mutant of the Dwarf or Cavendish variety, has given promising results in the course of four bulk storage trials. The bunches are larger than the Cavendish, while the cylindrical shape and symmetry of the bunch and the relatively tough skin of the fruits render it suitable for naked bulk transport. The degree of ripeness for storage is discussed in addition to response to varying degrees of temperature in storage. Shipping trials have yet to be made and the results of such trials should be of great interest.

The Cavendish or Governor variety proved very subject to mechanical injury and is unsuitable for export.

Similar work on other varieties is detailed, as a result of which it can be stated that certain varieties are unsuited to storage, while further trial on other varieties would appear justified.

D. H. G.

Departmental.

FROM THE DISTRICTS.

The Weather.

Conditions during March were nearly normal in Kedah and Kelantan, though the rainfall was somewhat below the average and in the eastern State the second half of the month was hot and dry. There was an average or slightly deficient rainfall in Province Wellesley, most parts of Perak and the inland northern half of Selangor. Around Taiping, in the Dindings and Sitiawan, on Cameron Highlands, in the remainder of Selangor and in all the south of the Peninsula from Negri Sembilan to Singapore Island, the rainfall was much above average, being especially heavy in the first half of the month when floods occurred in Johore and Singapore Island.

Remarks on Crops.

Rubber.—There was again a rise in the average price of rubber during the month. The lowest and highest prices in dollars and cents per picul recorded for rubber from small holdings were:—Smoked Sheet $16.50 to $24; Unsmoked Sheet $12 to $22.50; Scrap $4 to $10. The average Singapore prices for these grades were respectively $22, $20.50 and $7.50 as compared with $20, $18.50 and $8.50 in February. Penang prices for Unsmoked Sheet ranged from $19 to $22.50 as compared with $15 to $20.50 in February.

The fairly general wet weather rendered wintering irregular and prolonged so that in many areas it did not terminate until the end of the month. In spite of the wintering season, tapping was maintained over an increasing area and in some localities with increased severity under the stimulus of the rise in price.

A better return for the product has, however, led to improvement in the upkeep of small holdings, interest in the preparation of good quality sheet, including better facilities for smoking it before sale to dealers, and to the more extended use of approved disinfectants for the control of bark diseases.

Leaf mildew caused by *Oidium Heveae* was definitely recorded in Kedah for the first time, though its presence had previously been suspected. This disease appeared fairly generally in Penang and Province Wellesley, Selangor, Negri Sembilan, and Malacca and in parts of Perak and Johore. Its incidence was, however, on the whole not severe, owing to the unusually wet weather prevalent in many infected areas. Only two or three estates had resort to treatment with sulphur dust. It was observed independently in Province Wellesley and Negri Sembilan that trees which had wintered early appeared to have escaped infection.

Padi.—The price of padi at the Government Rice Mill, Bagan Serai, remained at $1.40 per picul, although a privately owned mill was offering $1.10

to \$1.20 per picul. The price in Kedah was equivalent to approximately 97 cents to \$1.25 per picul, and in Province Wellesley to about \$1.25 to \$1.30 per picul. Elsewhere prices varied in the villages between 4½ and 10 cents per gantang, being as high as 15 cents in some inland localities in Selangor.

Harvesting was nearly completed in Kedah, Province Wellesley and Penang, Krian and Malacca. Records of yields so far obtained indicate that crops in all these areas will be good. The Kedah crop is expected to approximate closely to that of last year, while in Krian about 150,000 piculs, or some 8,800 tons, of padi have already been purchased by the Government Rice Mill.

As anticipated, the harvest in other parts of Perak has been prolonged, with the result that yields have been variable and loss has been occasioned by wet weather during the past month. The position is similar in the new padi area in Sabak Bernam District of Selangor.

Work in preparation for the coming season has been commenced in the inland Districts of Selangor, in Negri Sembilan, except Kuala Pilah District, and in parts of Western Pahang and Johore.

Coconuts and Copra.—The price of copra remained very low, showing little change from that of February, being on an average \$2.30 per picul in Singapore. Prices elsewhere ranged from \$1.40 to \$3.30 per picul.

At the present price, copra production is hardly remunerative. Consequently, every opportunity is taken for sale of fresh nuts within the Peninsula and the local preparation of coconut oil as a village industry is increasing in some localities. It is reported from Johore that fresh unhusked nuts are being exported from Benut to China, the fibre being utilised there for rope-making and other purposes and the nuts being consumed.

Pineapples.—The supply of fruit increased during the month, but the peak supply for the season in Johore is not expected to be reached until April. Three factories were working in Singapore Island, seven in Johore and one in Selangor. Prices for fresh fruit in Johore were, first quality \$2.80 and second quality \$1.50 per hundred. Corresponding prices in Johore ranged from \$2.00 to \$2.20 and \$1.40 to \$1.50 delivered at the factory.

Legislation on the lines of the Colonial Ordinance to control and improve the industry was passed in Johore during the month.

In Selangor it was reported that some 420 acres had been newly planted with this crop.

Fruit.—A disease of durian trees in Penang Island was investigated. Its symptoms were very similar to those of Patch Canker of the rubber tree and the fungus *Phytophthora palmivora* (*faberi*), responsible for the disease of rubber trees, was found in the bark of the durians.

It is reported from Singapore that fresh lime fruits exported to England reached their destination in good condition and commanded high prices on the home market.

Vegetables.—Good crops of gourds, maize and tapioca were ripening on the temporary bunds of grass in Krian padi areas. Some headmen in South Krian are trying vegetable growing on the dry padi land itself. In Malacca, Chinese were growing vegetables on the padi land near markets after reaping the padi crop.

In Pahang west, the planting of food crops such as maize, tapioca and yams was in progress. This is becoming a regular annual practice just before the commencement of padi planting and is popular because it helps the peasants to supplement their food supply until the following padi harvest. The land used is not padi land and is generally held under temporary occupation licence.

Tobacco.—Prices for sun-dried tobacco leaves have ranged from $10 to $56 per picul according to quality in most parts of the country. In Malacca, a rise in price to about $35 per picul has led to renewed planting by Chinese on padi land. In Johore, interest in the crop has been well maintained with prices ranging from $30 to $80 per picul. In Singapore Island, prices have risen but supplies of leaf were scarce owing to successive floods in the chief tobacco growing areas.

Agricultural Stations.

Favourable weather conditions enabled progress to be made with planting programmes at all Stations, both in respect of permanent and annual crops.

The first stage of an experiment on the manuring of annual crops was concluded at the Selama Agricultural Station where it was found that plots on which a leguminous green manure had been turned in gave much better yields of gingelly than did those treated with non-legumes or grass. A parallel experiment at the Rembau Station gave very poor yields throughout.

An experiment on the manuring of ginger and turmeric was laid down at Selama, Cheras and Sungei Udang Stations.

At the Pineapple Experiment Station in Singapore a number of selected pineapple plants were planted out in rows from selections made at the Station itself and on an estate in the Island. Seeds from a number of selected pine-apples were sown in the Solar propagator and some commenced to germinate. Tobacco planted early in the month was almost a complete failure owing to heavy rain.

Six more Light Sussex pullets were received from England at the Sungei Udang Station and six local hens for cross breeding with the White Wyandottes were obtained for the Pineapple Station in Singapore. Yields of eggs at the Tanah Rata Experiment Station from the pure bred imported fowls continued to be satisfactory; the six Rhode Island Red pullets gave 123 eggs, each weighing over 2 ozs., during the month.

Padi Stations and Test Plots.

With three exceptions, harvest was finished, or almost finished, on all Padi Test Stations and Plots at the end of the month.

Results from the majority of the Stations and Plots were under examination in the Head Office. Siam 29 has again shown itself a high-yielding strain readily adaptable to conditions in many different parts of the country, in all of which it has done well. Its main defect is a rather weak straw. Mayang Ebos 203 has also done well at several of the northern Stations and Plots.

Work for the coming season has already been commenced on the two inland Test Plots in Selangor, the Jelebu Plot in Negri Sembilan and the Temerloh Plot in Pahang.

On the Kuang Plot in Selangor, the short term varieties of padi, planted between seasons, were ripening, but much of the grain was empty owing to damage by birds and possibly to unfavourable weather conditions.

Vegetable beds have been prepared and planted for inter-season trials on Bukit Merah Test Station in Province Wellesley and Kendong Padi Test Plot in Negri Sembilan.

A small supply of mushrooms was obtained from the bed of padi straw established at the Sungei Udang Test Plot adjoining the Agricultural Station in Malacca.

Rural Lecture Caravan.

The Caravan visited Kuala Langat District of Selangor from March 6th. to 15th., when lectures illustrated by lantern slides, models, photographs and specimens were given on poultry husbandry, the preparation of improved copra and coffee.

From March 16th. to 25th., five centres in the Seremban District of Negri Sembilan were visited, the subjects dealt with being poultry husbandry and treatment of mouldy rot disease of rubber.

Malayan Padi Competition.

Local competitions were held at 16 centres in Negri Sembilan during the month, the total entries aggregating 776. From among these, a limited number were selected for forwarding to the Malayan Exhibition to be held in Kuala Lumpur at the beginning of June. Exhibits from the large padi-growing area in Rembau sub-District were disappointing both in numbers and in quality. Exhibits at each centre were criticised, owners were informed of faults and the exhibition standards were explained.

DEPARTMENTAL NOTES.

Retirement of Dr. Jack.

Dr. H. W. Jack, Economic Botanist, has been granted full-pay leave for 3 months, 25 days from 31st March to 25th July, 1934, on abolition of office.

Dr. Jack joined this Department in May 1914, as Assistant Agricultural Inspector. In the following year he was transferred to instructional activities and in 1919 was appointed Economic Botanist.

His activities in the Department have been concerned with a number of crops, but his research work on padi is the best known and attracted attention beyond the confines of this country. His services in this direction received recognition by the confirment on him in 1930 of Membership of the Order of the British Empire.

His reputation on the field of sport is no less well known, both locally and in Europe. On two occasions he was a member of the Irish International Rugby football team and was for many years a prominent member of the Selangor Rugby team.

Dr. Jack will, in July, assume duty as Director of Agriculture, Fiji. His colleagues in this Department wish him every success in his new appointment.

Rural Lecture Caravan.

Experience gained in the past led to the suggestion that tours of the Rural Lecture Caravan would be more effective in conveying instruction if the Caravan were to remain in each centre visited for two days instead of one. In order to give in one day both a display of films teaching general lessons and lectures conveying more detailed information on special subjects, it was necessary to commence the lectures at about 4.30 in the afternoon, then to make a break of about two hours and commence displaying the films at 7.30 p.m. There were two main objections to this procedure. The time for the lectures and the break in the programme were found to be inconvenient to the audience, and the programme itself was so long that it was difficult to assimilate.

Consequently, it was decided to try the effect of spreading the programme over two days in each centre, the films being displayed on the first evening after dark, and lectures illustrated by models and lantern slides being given on the second evening. It was further decided to confine the lectures to not more than two subjects, each occupying about 20 minutes, and to allow an interval after each lecture for discussion and for examination of models and exhibits. The tables on which the latter were displayed were provided with electric lights supplied from the generator which could be switched over to the film projector or the lantern when the lights were not required.

A trial tour conducted in Kuala Selangor on these lines at the end of 1933 proved successful. In consequecne, this procedure has been adopted for all tours during the present year.

The agricultural subjects on which attention is mainly being concentrated are Poultry Husbandry, Preparation of Improved Copra, and Potential Money Crops for Small Holders. Three lectures on Poultry Husbandry have been prepared. These deal with housing, management of birds and feeding and sanitation. They are illustrated by means of models of houses and pens, protected feeding troughs and drinking troughs, all made of materials readily available to dwellers in the villages.

The lecture on the Preparation of Improved Copra gives details of the construction of a good type of simple kiln and of its correct use. Models of good and bad kilns are provided and also a set of lantern slides.

Money crops for small holders include such crops as tobacco, groundnuts, gingelly and fruit trees such as the Brazil nut and the avocado pear. Each of these is dealt with quite shortly and in a general manner, with photographs and specimens as illustrations, the object being to draw the attention of the audience to the possibilities of each, leaving details of planting and cultivation to be given to those interested by the local Agricultural Officers in the course of their regular duties.

Copra Investigations.

A separate Division of the Research Branch of the Department has been created to deal with Copra investigations. The Division will be under Mr. F. C. Cooke, A.R.C.S., B.SC., A.M.I. CHEM. E., Assistant Chemist for Copra Investigations, whose title in future will be styled Officer-in-Charge, Copra Investigations.

The reorganisation will date from 1st. May, 1934.

Leave.

Mr. W. N. C. Belgrave, Chief Research Officer, returned from leave on 4th. March, 1934.

Mr. G. H. Corbett, Government Entomologist, returned from leave on 29th. March, 1934.

Statistical.

MARKET PRICES.

March 1934.

Rubber.—The market price of rubber fluctuated during the month, opening at $16\frac{1}{4}$ cents per lb. for Spot loose in Singapore and closing at 17 cents per lb. The highest quotation was on the 16th of the month when the price reached $18\frac{3}{8}$ cents per lb. The average price for the month was $17\frac{1}{8}$ cents per lb. in Singapore, $5\frac{1}{8}$ pence in London and $10\frac{7}{8}$ cents gold in New York, as compared with $16\frac{1}{4}$ cents, $4\frac{7}{8}$ pence and $10\frac{1}{4}$ cents gold respectively in February.

Weekly prices during March for small-holders' rubber at Kuala Pilah, Negri Sembilan; Kuala Kangsar, Perak, and Batu Pahat, Johore, were as shewn in the following table:—

	VALUE PER PICUL (dollars)								
Grades	Kuala Pilah, Negri Sembilan.		Kuala Kangsar, Perak.			Batu Pahat Johore.			
	1.3.34	15.3.34	7.3.34	21.3.34	28.3.34	7.3.34	14.3.34	21.3.34	28.3.34
Smoked sheet	19.73					19.23	21.80	20.47	20.30
Unsmoked sheet	19.05	20.32						18.00	19.30
Rubber*			16.16	18.87	16.74				
Scrap		5.97							

* Wet unsmoked sheet.

Transport by lorry Kuala Pilah to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent.

Palm Oil.—The course of the market Liverpool/Continent during March on a basis of 5 per cent. f.f.a., c.i.f. was as follows: March 7th, £14.10.0 per ton net, March 14th. £13.15.0 per ton net, March 21st. £13.10.0 per ton net, and March 28th. £13.10.0 per ton net.

Prices in the U.S.A. landed weight per pound in bulk c.i.f. New York/Philadelphia were 2.75 cents gold on the 7th March, 2.62 cents gold on the 14th. March, 2.60 cents gold on the 21st. March, and 2.55 cents gold on the 28th. March.

The price of palm kernels Fair Average Malayan Quality c.i.f. landed weight on the Continent was shillings 7 per cwt. on March 7th., shillings 6/9 per cwt. on March 14th., shillings 6/6 per cwt. on March 21st., and shillings 6/3 per cwt. on March 28th.

Copra.—The price of copra fell during March. The highest Singapore price for Sundried during the month was $3 per picul, and the lowest price $2.65 per picul, the average price being $2.90 per picul as compared with $3 during February. The mixed quality averaged $2.31 per picul as compared with $2.40 per picul in February.

Coffee.—The price at Singapore for Sourabaya coffee remained fairly steady; prices ranged according to grade, from $20.75 to $21.50 per picul. Palembang coffee averaged $16.20 per picul during the month, being quoted at $16.75 per picul on the 2nd. and $16 per picul on the 30th. of the month; the average figure for February was $17.19 per picul.

Arecanuts.—There were no sales of Palembangs, Bila Whole or Kelantan in February, there being no stocks on the market. The range of Singapore prices for other grades were, Splits $7 to $11.50 per picul; Red Whole $2.30 to $5.90 per picul and Sliced $2.75 to $4.25 per picul.

Rice.—The average wholesale price of Siam No. 2 ordinary rice per picul in Singapore in February was $3.06, as compared with $2.91 in January. No. 1 Rangoon rice averaged $2.50 per picul in February as compared with $2.72 in January. Saigon No. 1 (long grain) averaged $2.60 per picul in February as compared with $2.65 per picul in January.

Tea.—During February, the average price quoted in London for Malayan tea was shillings 1/0.87 per lb. Average prices during February for tea consignments from other countries were as follows:—Ceylon shillings 1/3.75 per lb., Java shillings 1/0.71 per lb., Indian Northern, shillings 1/2.75 per lb. and Indian Southern, shillings 1/2.76 per lb.

Gambier.—The price of Block gambier remained steady during the month, averaging $4.19 per picul, Cube No. 1 averaged $6.69. Corresponding figures for February were $3.88 and $6.38 respectively.

Pineapples.—There was a slight fall in values during March, the average Singapore price per case being as follows:—Cubes $3.12, Sliced Flat $2.98 and Sliced Tall $3.06, as compared with $3.24, $3.06 and $3.19 respectively during February.

Tapioca.—The price of Flake Fair averaged $4.70 per picul as compared with $5.11 per picul in February. Pearl Seed averaged $5.80 per picul and Pearl Medium $6.38 per picul, both prices being similar to the average prices during February, namely $5.88 and $6.38 respectively.

Sago.—Pearl-Small Fair decreased slightly in price during March, averaging $3.65 per picul for the month; the average price was $3.76 per picul in February. Flour-Sarawak Fair averaged $1.87½ per picul as compared with the February average of $1.95 per picul.

Mace.—Prices were nominal during March, the average for the month for Siouw being $65 per picul, and for Amboina $40 per picul.

Nutmegs.—110's averaged in price during March $24.25 per picul, as compared with $21.25 per picul in February; 80's also increased in value, averaging $26.75 per picul against the figure of $24.25 per picul in February.

Pepper.—Average Singapore prices during March were as follows:—Singapore Black $15.69 per picul; Singapore White $29.88 per picul and Muntok White $30.75 per picul; the corresponding figures for February were $15.50, $29.12 and $30.50 per picul respectively.

Cloves.—Prices continued steady and nominal as in the previous month; Zanzibar averaged $35 per picul and Amboina $45 per picul.

Tuba Root.—There was a scarcity of supplies during March, the prices being nominal and similar to last month's averages, namely $25 to $30.50 per picul.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co., Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Mackay & Co., Singapore.

1 picul = 133 1/3 lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY.*

February 1934

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during February 1934, amounted to 41,623 tons, as compared with 46,275 tons in February 1933, of which 40 per cent. were consigned to Singapore, 24 per cent. to Penang, 7 per cent. to Malacca, 27 per cent. to the Federated Malay States and 2 per cent. to the Unfederated Malay States.

Of these imports, 57 per cent. were from Siam, 39 per cent. from Burma, 3 per cent. from Indo-China and 1 per cent. from other countries.

Total foreign exports of rice from Malaya in February 1934 were 9,576 tons (including 174 tons local production) as compared with 13,975 tons in February 1933.

Of these exports 68 per cent. were consigned to Netherlands India and 32 per cent. to other countries.

Net imports for the period January to February 1934, were 66,902 tons as compared with 67,152 tons during the same period for 1933, a fall of .4 per cent.

India and Burma.—Total foreign exports of rice during January 1934, were 77,000 tons as compared with 74,000 tons in December 1933 and 68,000 tons in January 1933, an increase of 4 per cent. in respect of the previous month and an increase of 13 per cent. in respect of the same period in the previous year.

The total area under rice (1933-1934) as reported in the Indian Trade Journal dated 1st March, 1934, was 81,977,000 acres as compared with 82,661,000 acres in the previous year, a decrease of .8 per cent. The total yield is estimated at 30,353,000 tons of cleaned rice as compared with 31,089,000 in 1932-1933, a decrease of 2.4 per cent.

Japan.—The production of rice in Japan (Proper) during 1933 amounted to 9,936,484 tons as compared with 8,469,859 tons the previous year or an increase of 17.3 per cent. The increase is due to considerable improvement of agricultural technique and continued favourable weather conditions.

The balance of stock of rice in Japan (Proper) on October 31st, 1934, after deducting requirements for export and consumption is estimated at 2,637,700 tons.

Imports of Korean and Formosan rice into Japan (Proper) were:

		1st Nov. 1933 to 20th Jan. 1934 tons.	1st Nov. 1932 to 20th Jan. 1933 tons.
Korea	...	338,429	385,835
Formosa	...	149,509	198,036

* Abridged from the Rice Summary for February 1934, compiled by the Department of Statistics, S.S. and F.M.S.

Siam.—Exports of rice from Bangkok (approximate) during February 1934, amounted to 140,961 tons as compared with 144,428 tons in February 1933, a decrease of 2 per cent.

According to the Second Forecast (1933-1934) the area planted at the end of December 1933, amounted to 7,638,000 acres as compared with 7,576,000 acres the previous year, an increase of .8 per cent. The total outturn is estimated at 2,969,000 tons of rice and the surplus available for export at 1,346,000 tons.

Note: The figures for 1934, are approximate.

Netherlands India, Java and Madura.—No further information to that published in the Summary for the month of December, 1933, is available.

French Indo-China.—Exports of rice from Saigon for the period January and February 1934, totalled 206,000 tons, an increase of 18,000 tons or 9.6 per cent. as compared with the corresponding period of 1933.

Ceylon.—Imports for the month of January 1934, totalled 44,939 tons, an increase of 8,527 tons on the imports for the same perood of 1933.

Of these imports 16 per cent. were from British India, 67 per cent. from Burma and 17 per cent. from other countries.

Europe and America:—Quantities of rice shipped from the East were:—

(*a*) To Europe for the period January 1st to February 15th 1934, 57,401 tons, a fall of 67,570 tons or 54 per cent. as compared with the same period of 1933. Of these shipments, 11 per cent. were from Burma, nil from Japan, 74 per cent. from Saigon, 12 per cent. from Siam and 3 per cent. from Bengal, as compared with 30 per cent. from Burma, 13 per cent. from Japan, 50 per cent. from Saigon, 6 per cent. from Siam and 1 per cent. from Bengal in 1933.

(*b*) To the Levant, period January 1st to January 17th 1934, 123 tons an increase of 87 tons or 242 per cent. as compared with the same period of 1933.

(*c*) To America and the West Indies for the period January 1st to January 22nd 1934, 49 tons an increase of 49 per cent. as compared with the same period of 1933.

MALAYAN AGRICULTURAL EXPORTS, FEBRUARY, 1934.

PRODUCT.	Net Export in Tons.				
	Year 1933.	Jan.-Feb. 1933.	Jan.-Feb. 1934.	February 1933.	February 1934.
Arecanuts ...	20,756	4,533	7,444	2,126	3,832
Coconuts, fresh ...	100,609†	16,154†	14,544†	9,139†	8,029†
Coconut oil ...	17,568	2,960	3,867	1,342	2,104
Copra ...	110,543	18,991	17,054	4,407	7,791
Gambier, all kinds ...	2,560	394	328	213	155
Palm kernels ...	1,983	199	346	134	186
Palm oil ...	12,101	562	1,664	157	1,367
Pineapples canned ...	59,582	9,025	8,832	4,312	4,165
Rubber ...	459,836§	67,388§	83,605	31,559§	41,832
Sago,—flour ...	7,648	1,369	1,088	713	437*
,, —pearl ...	2,646	348	475	219	220
,, —raw ...	4,420*	767*	768*	272*	304*
Tapioca,—flake ...	9,881	1,915	1,179	965	530
,, —flour ...	702*	364	213§	49	29*
,, —pearl ...	17,297	2,418	2,333	1,362	1,234
Tuba root ...	569½	43	106½	39	62

† hundreds in number. * net imports. § production.

NETHERLANDS INDIA RUBBER STATISTICS.

Acreage of Tappable Rubber not tapped at the end of January, 1934.

January 1934	A		B		C	
	Totally ceased		Partly ceased		Total A & B	
	Number of Estates	Area in Acres	Number of Estates	Area in Acres	Number of Estates	Area in Acres
Java ...	65	21,044	73	20,516	138	41,560
Outer Provinces ...	176	52,236	82	51,781	258	104,017
Netherlands India ...	241	73,280	155	72,297	396	145,577

The above acreages are converted from hectares, at 2.47 acres.

The total area out of tapping for January, 1934, amounts to 14.9 per cent. of the total tappable area at end of December, 1932.

MALAYA RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING FEBRUARY, 1934.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1932 (d)	Estates which have entirely ceased tapping		Estates which have partly ceased tapping		Area of tappable rubber never been tapped		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
STRAITS SETTLEMENTS :—									
Province Wellesley	44,734	1,323	2.9	7,302	16.3	1,082	2.4	8,625	19.2
Dindings	6,,969	209	3.0	865	12.4	546	7.8	1,074	15.4
Malacca	111,780	4,740	4.2	15,933	14.2	7,316	6.5	20,673	18.4
Penang Island	1,635	365	22.3	82	5.0	170	10.4	447	27.3
Singapore Island	28,269	8,021	28.3	4,743	16.8	248	0.9	12,764	45.1
Total S.S. ...	193,387	14,658	7.6	28,925	14.9	9,362	4.8	43,583	22.5
FEDERATED MALAY STATES :—									
Perak	250,951	3,991	1.6	27,715	11.1	14,225	5.7	31,706	12.6
Selangor	308,379	1,924	.6	36,479	11.8	12,564	4.1	38,403	12.4
Negri Sembilan	228,541	5,125	2.2	21,430	9.4	15,976	7.0	26,555	11.6
Pahang	38,141	5,227	13.7	5,207	13.6	5,086	13.3	10,434	27.3
Total F.M.S. ...	826,012	16,267	1.9	90,831	11.0	47,851	5.8	107,098	12.9
UNFEDERATED MALAY STATES :—									
Johore	325,747	20,794	6.4	32,442	10.0	21,470	6.6	53,236	16.3
Kedah (a) (b)	126,588	3,595	2.8	9,556	7.6	(e) 5,700	4.5	13,151	10.3
Kelantan	21,175	5,749	27.1	2,200	10.4	1,860	8.8	7,949	37.5
Trengganu (c)	4,395	Nil	Nil	1,561	35.5	Nil	Nil	1,561	35.5
Perlis (a) (b)	957	106	11.1	131	13.7	308	32.2	237	24.8
Total U.M.S. ...	478,862	30,244	6.3	45,890	9.6	29,338	6.1	76,134	15.9
TOTAL MALAYA ...	1,498,261	61,619	4.1	165,646	11.0	86,551	5.8	226,815	15.1

Notes :—(a) Registered companies only and are rendered quarterly.

(b) The figures quoted for Kedah and Perlis are those for end December 1933, and Kelantan end January, 1934 Revised figures will be published when available.

(c) Registered Companies only.

(d) Figures for end December 1933, are not yet available.

(e) Estimated: figures not yet available.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF FEBRUARY 1934 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month		
	Ports	Dealers	Estates of 100 acres and over	during the month	January and Feb. 1934	during the month	January and Feb. 1934	during the month: Foreign	during the month: From Malay States & Labuan	January and February 1934: Foreign	January and February 1934: From Malay States & Labuan	during the month: Foreign	during the month: Local	January and February 1934: Foreign	January and February 1934: Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States ...	...	12,267	12,309	11,163	23,504	11,175	20,938	Nil	Nil	Nil	Nil	17,384	2,680	31,831	11,189	...	15,490	11,345
Johore ...	...	3,362	3,024	4,029	7,273	5,168	9,731	Nil	4	Nil	10	1,399	6,959	3,209	13,063	...	3,935	3,294
Kedah ...	...	406	2,487	2,766	5,892	1,632	3,599	Nil	Nil	Nil	Nil	1,668	2,887	2,899	6,688	...	384	2,352
Perlis ...	...	24	9	8	29	34	68	Nil	Nil	Nil	Nil	Nil	38	Nil	103	...	22	15
Kelantan ...	...	393	195	294	484	749	1,684	13	Nil	121	Nil	92	909	146	1,918	...	382	261
Trengganu ...	...	55	50	198	398	98	197	Nil	Nil	Nil	Nil	Nil	296	Nil	595	..	55	50
Total Malay States	...	16,507	18,074	18,458	37,580	18,856	36,217	13	4	121	10	20,543	13,769	38,085	33,556	...	20,268	17,317
STRAITS SETTLEMENTS :-																		
Malacca ...	...	2,649	1,220	1,376	2,698			Nil		1		3,284		7,522		...	3,427	1,182
Province Wellesley	...	1,029	692	525	1,155			Nil		Nil						...	926	543
Dindings ...	...	70	139	104	219	2,325	5,372	Nil	16,198	Nil	33,280	8,913	Nil	17,046	Nil	...	58	152
Penang ...	2,939	6,536	13	9	29			1,742		3,677						3,116	5,877	9
Singapore ...	6,159	32,045	143	179	335			13,074		27,158		25,127		50,269		4,961	34,215	159
Total Straits Settlements	9,098	42,329	2,207	2,193	4,436	2,325	5,372	14,816	16,198	30,836	33,280	37,324	Nil	74,837	Nil	8,077	44,503	2,045
TOTAL MALAYA	9,098	58,836	20,281	20,651	42,016	21,181	41,589	14,829	16,202	30,957	33,290	57,867	13,769	112,922	33,556	8,077	64,771	19,362

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
20	21	22	23	24	25	26
DRY RUBBER	11,625	29,396	4,912	3,626	1,733	115
WET RUBBER	3,865	4,819	965	785	2,202	269
TOTAL ...	15,490	34,215	5,877	4,411	3,935	384

TABLE III
FOREIGN EXPORTS

PORTS	For month	January and Feb. 1934
Singapore ...	35,097	71,619
Penang ...	14,570	26,756
Port Swettenham.	7,479	13,030
Malacca ...	721	1,517
MALAYA ...	57,867	112,922

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January and Feb. 1934
Malay States ... / Straits Settlements	42,389	82,496
MALAYA ...	42,389	82,466

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption. *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + 15 tons local consumption during the month —[2]—[3]—[4]—[5]—[9]—[10]. For the Straits Settlements, Columns [9] and [10] represent purchases by dealers from local estates of less than 100 acres, reduced by 15 % to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5 The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 23rd March 1934.

METEOROLOGICAL SUMMARY, MALAYA, FEBRUARY, 1934.

Locality	Air Temperature in Degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total	Total	Most in a day Amt.	Number of days: Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total	Daily Mean	Per cent
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.								
Railway Hill, Kuala Lumpur, Selangor ...	91.1	70.9	81.0	95	68	85	72	83.3	83.8	8.84	224.5	3.27	14	12	1	1		152.65	5.45	45
Bukit Jeram, Selangor ...	88.2	71.7	79.9	91	70	81	73	85.3	85.5	0.38	9.7	0.23	6	2				162.55	5.80	48
Sitiawan, Perak ...	87.6	71.0	79.3	91	68	79	74	82.7	83.5	4.49	114.1	1.18	12	10	1			175.40	6.26	52
Temerloh, Pahang ...	85.5	70.9	78.2	91	68	74	73	81.3	83.1	1.94	49.3	0.51	9	8				128.40	4.59	38
Kuala Lipis, Pahang ...	84.4	69.8	77.1	90	67	72	72	80.9	82.0	6.17	156.7	1.50	16	14	2	15		107.75	3.85	32
Kuala Pahang, Pahang ...	82.1	73.3	77.7	86	67	76	77	80.5	81.5	8.93	226.8	3.69	13	11				131.40	4.69	39
Mount Faber, Singapore ...	84.7	70.8	77.7	89	69	73	73	78.7	79.3	6.07	154.2	1.90	15	13	3	1		157.80	5.64	47
Butterworth, Province Wellesley ...	86.6	71.8	79.2	91	69	79	75	83.1	84.2	2.14	54.4	0.68	10	7				181.95	6.50	55
Bukit China, Malacca ...	85.8	72.0	78.9	90	69	81	74	81.2	81.6	3.79	96.3	3.05	7	7	1			171.10	6.11	50
Kluang, Johore ...	85.1	70.3	77.7	91	66	73	72	78.3	79.2	7.97	202.5	2.17	14	13	1	2		154.60	5.52	46
Bukit Lalang, Mersing, Johore	81.3	71.5	76.4	85	67	75	75	77.6	78.3	9.57	243.1	3.74	14	10	1					
Alor Star, Kedah ...	88.6	69.6	79.1	93	64	81	73	81.7	83.3	1.41	35.8	0.68	7	6	4	2		169.85	6.07	51
Kota Bahru, Kelantan ...	83.6	70.9	77.3	89	65	77	74	79.5	81.4	6.70	170.2	2.11	16	10				142.00	5.07	43
Kuala Trengganu, Trengganu	82.9	70.6	76.7	87	65	77	74	79.4	80.4	5.80	147.8	1.30	14	10	1			143.80	5.14	43
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. Pahang ...	69.7	59.9	64.8	80	58	62	63	69.0	69.4	4.27	108.5	0.80	19	15	5	15		78.25	2.79	23
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	70.3	55.1	62.7	73	46	64	61	67.5	68.3	6.19	157.2	2.52	12	9		2	1	105.85	3.78	31
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ..	69.9	57.3	63.6	74	53	63	60			6.43	163.3	3.24	11	10		1	1	107.40	3.84	32

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THE

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MAY, 1934.

EDITORIAL.

Dairy Farming in Malaya.

The policy in many countries to-day is to encourage local production instead of relying on imports of staple commodities. This policy is largely dictated by the present international currency difficulties and the tariff barriers erected by the Governments of most countries. Whereas, in the past, nations have relied on a favourable trade balance, such a view has been partly superseded by local production for internal consumption with the object of rendering the country more self-supporting at least in the provision of foodstuffs.

The widespread new policy finds its advocates and opponents amongst the economists, but without entering into the discussion of such a controversial subject, we desire briefly to state the position in Malaya in relation to dairy farming. Normally, the value of the net imports of milk and butter into Malaya exceeds $10,000,000 annually. With the lower values of our important export products, any diminution of this large bill for imported dairy products is desirable.

We would remark, however, that the experimental work of the Department of Agriculture into dairy-farming problems was inaugurated some eight years ago, at a time when local production to replace imports was less the accepted principle than it appears to be to-day. While even at that time, local production was held to be a virtue in itself, there were other and more convincing reasons which rendered desirable the improvement of dairy farming in Malaya.

In the first place, there existed a considerable, though very scattered, dairy industry throughout the country, and Indian-owned herds of cattle still exist near almost every centre of population. The produce was sold almost entirely to Asiatics.

Secondly, the stock from which this milk was obtained was generally inferior. It was therefore desirable that investigations should be put in hand with the object ultimately of improving the yield and quality of the milk. These investigations have necessitated consideration of such problems as breeding and cross-breeding suitable animals and feeding.

Thirdly,—and perhaps most important—the investigation of this subject has as its object the desirability of marketing fresh, pure and rich milk. The great advantage of the imported milk is its purity. This fact was the reason

for justified reluctance of the public to purchase locally-produced milk which might possibly be obtained from unhealthy stock kept under unhygienic conditions. Unless locally-produced milk can be guaranteed rich and pure, the public are well advised to continue to consume the imported product. On the other hand, if milk of guaranteed purity can be produced in Malaya, experience shows that it will be in demand.

The work at Serdang, which is described in this number, demonstrates that very real progress has been made. We are able to market a rich milk of guaranteed purity, and to maintain the supply throughout the year. The investigations are, of course, still in progress and it must be some years before anything approaching finality with regard to the most desirable type of animal can be claimed. Breeding trials, in particular, are incapable of early conclusion. The results to date, however, are extremely encouraging and we appear to be advancing to a stage where the up-grading of local stock can be taken in hand with confidence.

Controlled Drainage and Irrigation.

With the object of adding considerably to the acreage available for padi planting in Malaya, the Department of Drainage and Irrigation is carrying out work on schemes to provide several areas with a controlled water supply either by means of irrigation or by systems of controlled drainage. Among the most important of these areas is that in the mukim of Panchang Bedina in the Sub-District of Sabak Bernam, Selangor, where a system of controlled drainage is under construction which will render 15,000 acres of land available for padi cultivation.

In an interesting article in this number Mr. Miller, Drainage and Irrigation Engineer, Telok Anson, gives an account of the engineering work in progress.

In connexion with this article, we take the opportunity of adding some particulars of the agricultural side of the work.

As soon as it became known that work on the drainage scheme was about to be commenced, a number of applications for land in the area affected were received. Most of the land first taken up was situated on either side of the main drainage channel, but the demand for land soon outstripped the rate of progress of the work. Consequently, the blocks on which jungle was felled with a view to planting padi were scattered, resulting in difficulties of pest control.

Felling, burning and clearing were carried on under difficulties, since the land was wet and the numerous clumps of nibong palm offered serious obstacles to clearing. These difficulties are clearly shown in Mr. Miller's article.

To meet the demand for seed padi, the Department of Agriculture imported from Krian and other parts of the Peninsula some 10,000 gantangs of which 4,000 gantangs were seed of suitable pure strains and the remainder seed of mixed padi.

At the same time, the Department selected, felled, burned and cleared sites for two Padi Test Plots, one of about 6 acres on the main canal and another of about 4 acres at Sungei Haji Durani further inside the area.

These plots and much of the felled area were successfully planted in the latter half of 1932, but difficulties arising from damage to nurseries by rats had to be overcome.

Subsequently, rats appeared in large numbers and wrought havoc among the standing crop which was also attacked by stem borers. The prevalence of jungle stumps, especially nibong, and unburnt tree trunks on the land render measures for the control of rats very difficult, since they afforded excellent shelter for the pest. As a result, the initial crop obtained from this area was very small.

During the year 1933 further areas of jungle were felled and the work of clearing the land planted in the previous season was continued. The result has been that some 5,500 acres were planted with padi for the season 1933-34. After a somewhat late start, due to drought, growth was good. Rats appeared suddenly in large numbers early in 1934, but vigorous control measures were carried out successfully under the supervision of the administrative and agricultural officers. The crop now being reaped bids fair to give fairly satisfactory returns.

In addition to establishing the two Padi Test Plots, the Department of Agriculture has stationed a Malay Agricultural Subordinate in the Sub-District to give advice on padi work, and the appointment of a second officer is contemplated. The plots will serve to determine which pure strains of padi are best suited to local conditions and to demonstrate their value, and it is hoped to ensure that the area will soon be planted throughout with two or three pure strains giving good yields of grain of uniform size and ripening evenly over the whole area. Even ripening reduces damage by pests, especially birds, and uniformity of grain is an important factor in the production of rice of good quality when the padi is milled.

The probable future need for milling facilities in this extensive and somewhat remote area has not been overlooked. Attention has already been given to the selection of a suitable type of mill and steps have been taken to provide funds for its estimated cost.

The development of this large area of padi land will prove a valuable permanent addition to the cultivated land of this country and will be an important local source of production of rice.

THE GOVERNMENT DAIRY FARM, SERDANG

BY

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Introductory.

The Government Stock Farm at Serdang is a branch of the Central Experiment Station, Serdang and is administered by the Officers in charge of the Station. It was commenced in 1926, principally with the object of carrying out research on methods of improvement of milch cattle of Malaya, but also of providing a supply of high-grade milk to Government Hospitals and to the general public.

The present article describes some of the problems connected with such a project, the various investigations now in progress, and the results so far obtained.

There is no indigenous domesticated breed of cattle in Malaya, the stock at present in the country consisting mostly of direct importations of cattle for draught and beef purposes, or the progeny of such animals.

The Indian dairymen, in or near the towns in Malaya, have made a few sporadic importations of milch cattle of various Northern Indian breeds, which are reputed to be better milk yielders than some of the Southern Indian breeds. In addition, a few Australian grade cattle of European breeds have been imported at various times by them; generally speaking, however, the introductions have been of the wrong type for dairy purposes and, in consequence, the milk yield of Malayan cows is exceptionally low.

In fact, the methods of animal husbandry generally practised by the average Indian dairyman tend to cause the degeneration rather than the improvement of livestock and, apart from work in the Government Institutions, very little effort has been made to improve the local milch cow.

Breeding Policy.—The principal objects in establishing a stock farm at Serdang were briefly, as follows:—

(1) The maintenance of a herd of pure-bred Montgomery cattle, from which, by continuous selection and up-grading, an improved strain of animal could eventually be produced with a view to:—

- (*a*) the production of a supply of high-grade fresh milk for Government Hospitals and the general public,
- (*b*) the distribution of high-class bulls for stud purposes,
- (*c*) the production of draught animals from surplus bulls.

(2) The introduction of high-class Friesian bulls for cross-breeding with the Montgomery cows.

(3) The determination whether imported Friesian stock can be acclimatised on the plains in Malaya with a view to establishing a small herd of pure-bred animals to provide a supply of stud bulls for crossing purposes.

The Montgomery breed was selected for trial as being the most likely to meet local requirements, that is, the production of milk and draught animals. According to reports, this breed has, during recent times, been selected for milk production to a far greater extent than any other in India and has been used for many years as the foundation stock for cross-breeding experiments both by Military Farms and the workers of the Agricultural Research Stations in many parts of India, including the Stock Farm of the Imperial Department of India at Pusa. As a result, the cows are usually considered to be better milkers than those of any other Indian breed.

Sources of the Livestock.

A start was made in October, 1926, when a small herd of pure-bred Montgomery or Sahiwal cattle, comprising four cows, one two-year-old heifer, one two-year-old bull and one yearling bull, was introduced at Serdang. The original stock was introduced from the Indian Government Stock Farm at Pusa. In addition to the above, a pure-bred Montgomery bull introduced from Pusa in October, 1924 by the Department and loaned to the Central Mental Hospital, Tanjong Rambutan, was transferred to Serdang in July 1926, for use as stud bull.

In June, 1928, two Australian Ayrshire cows, with two calves at foot, were presented to the farm by H.H. the Sultan of Johore.

At the end of 1928, the herd was further augmented by the introduction of four pure-bred Montgomery incalf cows and one Montgomery bull from Pusa.

In October, 1929, two high-class pedigree Friesian bulls ("Refiner" and "Controller") were introduced from the Hong Kong Dairy Farm with a view to increasing the milking qualities of the herd.

In June, 1930, six pure-bred Friesian incalf heifers were introduced from Australia in order to test the suitability of pure-bred Friesian cows on the plains in Malaya.

At the beginning of 1932, a pure-bred Jersey bull, six Jersey-Montgomery cross-bred cows and one Indian cow were transferred from the Government Dairy Farm at Fraser's Hill, and at the end of that year the milking stock was further increased by the purchase locally of two Indian cows of mixed origin.

The herd has naturally increased as a result of breeding and, after allowing for the sale of a large number of young bulls for stud purposes, at the end of 1933 there were 51 head of cattle on the farm, as detailed in the following table:—

Breed.		Cows.	Heifers.	Bulls.	Bull Calves.
Montgomery	...	12	2	2	1
Friesian	...	3	3	2	—
Friesian ½ x Montgomery ½	...	1	6	—	5
Friesian ¾ x Montgomery ¼	...	—	1	—	—
Jersey Crossbreds	...	5	1	—	—
Indian (locally-bred)	...	3	2	—	—
Montgomery ½ x Indian ½	...	—	1	—	—
Fries. ½ x Jer. ¼ x Mont. ¼	...	—	1	—	—
Total	...	24	17	4	6

Situation and Climate.

The farm is situated at Serdang in the State of Selangor and is approximately 3° North of the equator. The climate is monotonously equable and shows little variation throughout the year in the mean minimum and mean maximum temperatures.

The mean minimum temperature recorded at Serdang is 72°F., whilst the mean maximum is 91°F.

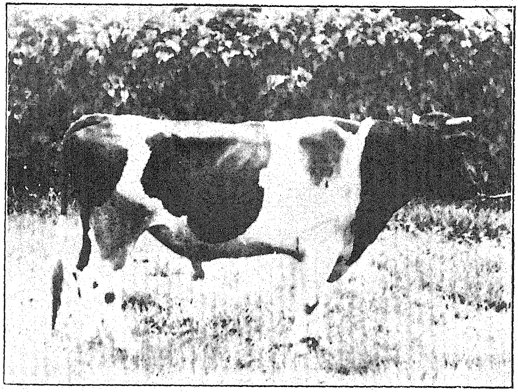
The rainfall is fairly evenly distributed throughout the year, there being no pronounced long dry seasons, and the average total rainfall is about 93 inches per annum. On the average, there are 165 wet days during the year.

The continuous luxuriant growth of vegetation throughout the year, even during the driest months, is such that the preservation of fodder in the form of hay or silage is unnecessary.

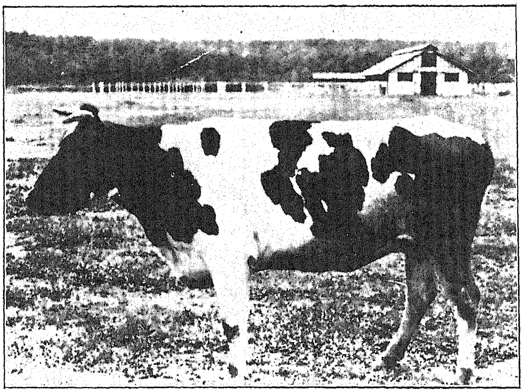
Buildings and Water Supply.

Buildings.—The farm buildings, which are mostly of the semi-permanent type, comprise the main cattle byre, one set of six calf and young stock boxes and one set of two bull boxes.

The main cattle byre is a building 75 feet long and 33 feet wide, constructed of wood and expanded metal, with roof of cement-asbestos sheets, the floors and feeding troughs being of cement-concrete, while stalls and



"CONTROLLER". FRIESIAN BULL. IMPORTED.



FRIESIAN COW. IMPORTED.

Conclusions.

The etiolation method of propagation has proved successful for a number of fruit trees and also for tea, and it appears possible that this method can be adopted for a number of woody plants that are difficult to propagate by other means.

The advantage of this method of propagation is that once an etiolation bed has been established, a constant supply of young plants can be obtained. To attain this end, however, care should be taken not to remove every shoot that produces roots but to leave a sufficient number for laying down in the future, so that the bed may always be well furnished with rooted plants.

The preliminary work of collecting suitable material for the laying down of beds takes time. It is unsatisfactory to put down plants which, if rooted successfully, will give planting material of unknown or inferior quality. Care should, therefore, be taken to select for this purpose only parent trees which are known to produce good quality fruits.

It is too early to state how trees propagated by this method will thrive when planted out, but there appears to be no reason why they should not behave in a similar manner to trees propagated by marcottage or cuttings.

Summary.

1. The etiolation method of propagation and the reasons for its adoption has been discussed.
2. The methods used at East Malling is given, and also some modifications which have been found expedient when applying it to tropical fruit trees in Malaya.
3. The methods adopted at the Central Experiment Station, Serdang, are given and the results, so far obtained, are discussed.

References.

1. R. G. Hatton, M.A., Director, East Malling Research Station. "Masters' Memorial Lecture, 1929—Stock and Scion Relationship", *Journal of the Royal Horticultural Society*, Vol. LV, 1930, p. 169.
2. J. N. Milsum and T. D. Marsh, "The Propagation of Tea from Etiolated Shoots", *Malayan Agricultural Journal*, July 1933, p. 310.

stanchions of the modern steel type have been fitted. The feed room and milk room are situated at one end of the building, being separated by a passage to the byre.

The set of six calf and young stock boxes are contained in a similarly constructed building 51 feet long and 17 feet wide, with a 4-foot feeding passage at the back and a 4-foot open verandah on the front. Each box is fitted with two half doors, which open out on to the verandah.

The two bull boxes are contained in a permanent building 21 feet long and 20 feet wide, constructed of cement-concrete with cement asbestos roof. A feeding passage 4¼ feet wide is provided at the back and the double half doors open on to a 6½ foot verandah.

Water Supply.—In all the buildings there is a continuous supply of pure water for each animal on the central tank principle.

Rubber Flooring.—It may here be mentioned that in the byre an experiment is being made, in collaboration with the Rubber Research Institute of Malaya, to ascertain the suitability of rubber flooring for cattle standings. In March, 1933 the floors of three stalls were relaid with a cement-rubber composition devised by the Rubber Research Institute in the course of its rubber roadway trials. After several months wear the spreads showed no sign of ageing or deterioration in any of the stalls.

Pasturage.

An area of approximately 60 acres of land has been allotted to grazing paddocks and a further 20 acres to the cultivation of Guinea grass for green soiling. Roughly, 40 acres of the pasture land can be classed as poor and the balance of 20 acres, situated in a low-lying position, as almost infertile.

These lands were all provided with open drains, but later a portion of the low-lying area was underdrained with subsoil pipes. Although the cost of subsoil draining was high, the result is very satisfactory and the grass on this area has much improved since the operation was carried out.

Owing to previous cultivation of the 40 acres grazing field, situated on higher land, a stand of natural grasses, intermixed with various leguminous cover plants, took possession of the ground, which very soon provided excellent pasturage. The block was free of lalang grass (*Imperata arundinaceae*) in the first instance, but it was found, after only a few months, that it commenced to make its appearance and a regular patrol has since been necessary to effect control.

The cost of this is estimated at one cooly day monthly for every five acres. No relaxation of effort in this respect is possible, otherwise the lalang grass would obtain such a hold on the land that its eradication would later become very costly. It will be seen, therefore, that the cost of such a patrol is likely to be a steady drain in labour charges on stock farms in Malaya, if first class pasturage is to be maintained.

Experience has shown that in laying down a pasture in Malaya it is advisable to establish a mixture of indigenous local grasses, such as cow grass (*Paspalum conjugatum*) and carpet grass (*Axonopus compressus*). Dallis grass (*Paspalum dilatatum*), an Australian grazing grass, has been planted with success in this country, but it is gradually replaced by the stronger-growing local grasses and it is quite impossible to keep it, or any other grass, as a pure stand for any length of time.

The policy recommended is to use fenced areas of limited acreage for combined grazing and exercise purposes and to permit the native low-growing grasses to take possession of the land; provided that lalang is kept under control, the stand of grass will consist principally of the indigenous *Axonopus compressus,* which is a good grazing grass.

It may be added that in order to prevent the breeding of flies and the fouling of the ground, it is important that cattle excrement on the grazing area should either be spread or removed at least once a week.

Fodders.

Fodder Grasses.—In view of the comparatively low feeding value of the pasturage, it is necessary, under Malayan conditions, to supplement grazing by stall-feeding with more highly nutritious grasses, such as Guinea grass (*Panicum maximum*), Merker grass (*Pennisetum merkeri*) or Napier grass (*P. purpureum*), all of which have been established at Serdang.

Of these three, Guinea grass is to be preferred and is the principal fodder crop grown on the farm.

Guinea Grass.—This fodder grass has been established on approximately 20 acres and is planted at a distance of 3 feet x 3 feet square. The grass is cut at intervals of about 3 weeks and when grown on land newly-opened from jungle has yielded over 40 tons of green grass per acre per annum. In order to maintain such a high yield, however, high cultivation, and heavy manuring is required.

Investigations designed to ascertain the yield of Guinea grass when cut at varying intervals from one to four weeks, and the amounts of plant nutrients removed from the soil thereby, showed that when moderate dressings of fertiliser were applied, yields at the rate of about 15 tons per acre per annum were obtained on previously cropped land. The most suitable interval of cutting was found to be there weeks (1), at which stage the grass is probably the most palatable.

It is probable that the best results will be obtained by replanting at intervals of 3 or 4 years.

The quantity of cut Guinea grass allowed to adult stock for stall-feeding is restricted to 40 lbs. per animal per diem, while young stock receive from 15 to 30 lbs. each per diem, according to age.

Compare with Guinea on opposite page.

Merker Grass.—This is a tall, coarse, erect-growing grass, attaining a height of about 8 or 12 feet. It is easily propagated from portions of the mature stock and the usual planting distance is 5 feet x 5 feet square. The first cutting is taken six months from the date of planting and subsequent cuttings are made every four weeks. Under good conditions, approximately 60 tons of fresh fodder per acre per annum are obtained.

When cut in the young state it is an excellent fodder for all classes of cattle but, as the stems mature, the fodder becomes coarse and unpalatable, in which stage it is useless for feeding purposes.

Napier Grass.—This is a tall, coarse-growing, perennial grass, very similar to Merker grass, but having a more vigorous root system, it resists drought. Propagation is effected by short stem cuttings, which are planted 5 feet x 5 feet square.

As in the case of Merker grass, harvesting may commence at about six months from planting, subsequent cuttings being made at intervals of 4 to 6 weeks.

Leguminous Fodders.—The high protein, phosphoric acid and lime content of leguminous fodders profoundly influences the rate of growth of young animals and milk production of cows in temperate climates; consequently they are extensively fed in European countries. In striking contrast, little use is made of legumes in Malaya for stock feeding.

Numerous trials have been made with a number of legumes at Serdang, but with unsatisfactory results. On small experimental plots, on land of average fertility, yields of about 7 tons of green fodder per acre have been obtained with cow peas (*Vigna unguiculata*), while horse gram (*Dolichos biflorus*) has yielded over 8½ tons of green matter per acre.

Trials have also included Soya bean (*Glycine hispida*), Bengal gram (*Cicer arietinum*), and Black gram (*Phaseolus Mungo* var. *radiatus*), but the yields in all cases were very low.

Lucerne or alfalfa (*Medicago sativa*) has also been tried repeatedly at Serdang and on each occasion has proved a complete failure.

If satisfactory leguminous fodders could be found it would no doubt be advantageous, but their inclusion in stock rations in Malaya is probably of more importance in the case of imported European breeds than of native animals.

Rations for Stock.

Observations have shown that a ration of 40 lbs. of Guinea grass per day fed in the stalls, with grazing *ad libitum,* will fatten dry (pregnant) Indian Montgomery cows without the addition of any concentrates; on the other hand, dry Friesian cows require concentrates in addition. This is probably due to the greater power of digestion of Indian cows and also probably, in part, to the lower vitality of imported Friesian stock in the tropics.

Under these conditions, there appears to be no necessity for a maintenance diet for Indian cows other than grass, except for a few weeks prior to calving. Consequently, it is the practice on the farm to feed a production ration a little in excess of that required for the daily yield of milk in the case of the Indian cows, whilst the Friesian cows are given a full maintenance diet, along with a production ration having a slight excess of proteins in its composition.

These feeding methods induce the cows to secrete their maximum yield of milk. If, in feeding, it is noticed that individual cows put on flesh instead of yielding milk, the ration is reduced accordingly, since in such cases it is obvious that the ration is in excess of the needs for milk production.

The following particulars show the standard rations employed at Serdang for mature cows and calves :—

(*a*) *Mature Cows.*—

Animals of 800 lbs. live weight and yielding 1 gallon (10 lbs.) of milk per day are given 40 lbs. of Guinea grass per diem and allowed to graze in addition, while the ration of concentrates given to cows in milk is as follows :—

Rice bran	2 lbs.
Crushed Horse or Bengal gram ...	½ lb.
Coconut cake	1 lb.
Gingelly cake	2 lbs.

An allowance of 2½ lbs. of this mixture is given as a maintenance ration to all cows in milk and those which cannot maintain their condition on Guinea grass alone.

An extra 3 lbs. of the ration is added for each gallon of milk produced.

(*b*) *Calves.*—

The young calves are fed on whole milk until they are about one month old. Afterwards, they are given a reduced ration of milk, which is supplemented with half a pound of linseed cake per day.

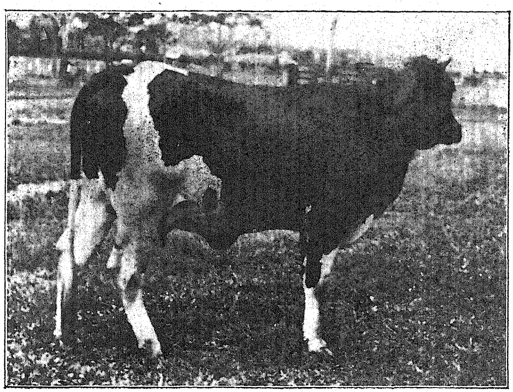
From six months onwards they receive a mixture of the following concentrates :—

Rice bran	3 parts.
Crushed Horse or Bengal Gram ...	1 part.
Linseed cake	1 part.

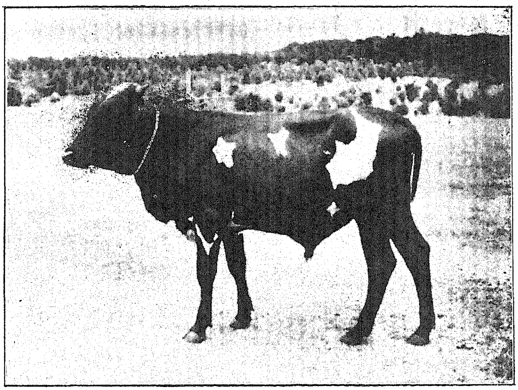
This ration is fed at the rate of ½ to 2 lbs. per day, according to age, until the animals are two years' old. In addition, they are allowed Guinea grass *ad libitum*, which amounts to about 30 lbs. per day for the two-year-old animals.

Milking Routine.

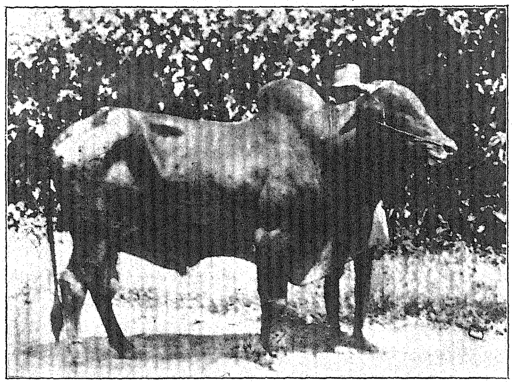
Milking is carried out twice daily; at 4.30 a.m. and at 1.30 p.m. Every precaution is taken to ensure a clean supply of milk and immediately before milking, the byre is hosed down and the cows' udders are carefully washed with



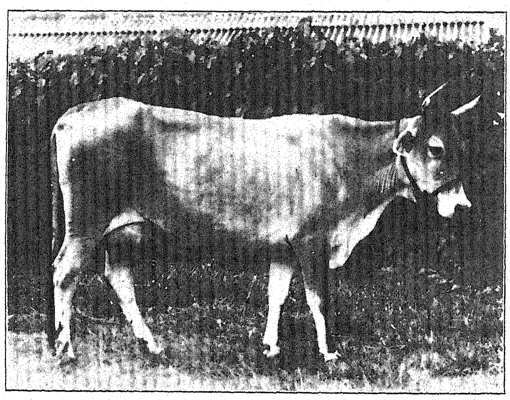
FRIESIAN × MONTGOMERY HALF-BRED HEIFER.



FRIESIAN × MONTGOMERY HALF-BRED BULL CALF.



Malayan bred Montgomery Bull.



Jersey × Montgomery Half-bred Cow.

soap and water. The milkers are provided with clean white smocks, which they wear until the milking is finished and all the milk has been passed on to the adjoining milk room.

Hand-milking is practised at present, but it is hoped that later a trial will be made with milking machines.

The milk is weighed immediately it is drawn and the morning and evening yields of each cow are recorded on a standard type chart. After weighing, the milk is poured into a funnel and passes through the wall of the milk room, where it first flows through a filter of cotton wool and then over a milk cooler, through which a stream of cold water from a refrigerator is delivered. By this means, the temperature of the milk is reduced to about 60°F. Immediately after cooling, the milk is bottled in regulation pint and half-pint bottles, capped with paper discs, the latter being covered with a thin layer of paraffin wax, which is impressed with a special seal and is then ready for delivery.

After each milking, all dairy utensils and bottles are washed, first in cold water, then in hot water and afterwards steam sterilised.

Quality of the Milk.

Owing to the prevailing high air temperature and the resultant intense bacterial activity, great care is necessary to produce high-grade milk on the plains in this country and continuous supervision of the labourers is necessary to maintain the degree of cleanliness required.

Surprise sampling of the milk is carried out monthly by Inspectors of the Health Department and the samples are submitted to the Institute for Medical Research for bacteriological and chemical examination.

It has been found possible to keep the bacterial counts of samples well below the standard of "Certified Milk" (30,000 per c.c.).

Table I shows the results of the latest reports from the Health Officer, Inland Districts, Selangor.

The average butter fat content of the different breeds is in all cases well over the legal standard in the Federated Malay States of 3.25 per cent.

Particulars of yields of milk obtained from the different breeds of cattle in the herd are also given in Table II. Although the farm has only been established for a comparatively short period and therefore sufficient time has not yet elapsed to show the results of upgrading for milk production, the increased yield obtained from both imported Friesian, Indian and Cross-bred stock compared with locally-bred Indian cows is suggestive.

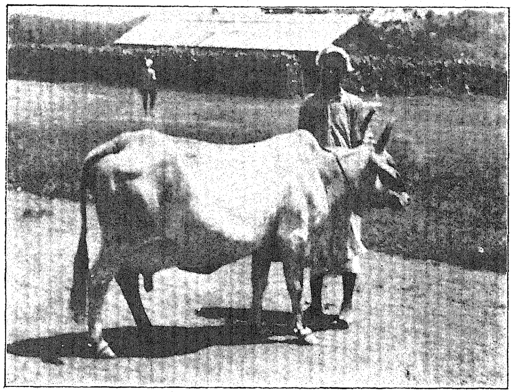
The suckling of the calves during the lactation period affects the yields of the Indian cows adversely as compared with pure-bred Friesian and Cross-bred Jersey-Montgomery cows, from which calves are removed at birth.

Table I
Bacteriological Examination of Milk Samples from the Government Dairy Farm, Serdang.

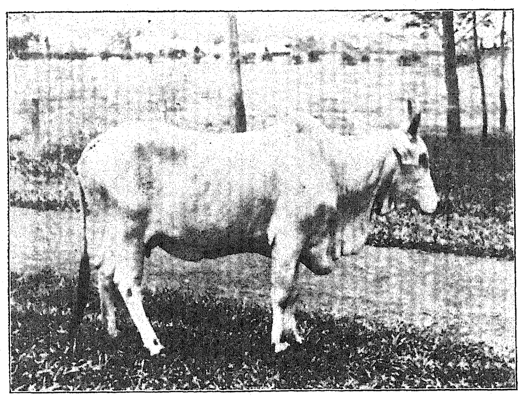
Date.	Sample.	No. of Organisms per c.c. developing on Agar at 37oC.		"B. Coli" absent from:	
		24 hrs.	48 hrs.	24 hrs.	48 hrs.
22-1-34	No. 1	2,500	3,500	1 c.c.	1 c.c.
	,, 2	1,600	2,000	1 c.c.	1 c.c.
27-2-34	,, 1	150	300	1 c.c.	1 c.c.
	,, 2	250	450	1 c.c.	1 c.c.
20-3-34	,, 1	350	400	1/10 c.c.	1/10 c.c.
	,, 2	300	350	1/10 c.c.	1/10 c.c.

Table II.
Particulars of the Yields, Lactation Period, and Average Butter Fat Tests of the Different Breeds of Cattle at Serdang.

	Milk Yield in pounds.	Lactation Period.	Average Butter Fat Test.	
	lbs.	Days.	a.m.	p.m.
Montgomery Cows:				
No. 22 ...	4,577	481	5.2	6.0
No. 2 ...	3,458	306	4.0	4.5
No. 3 ...	2,099	419	4.1	4.2
No. 4 ...	3,421	344	3.6	4.1
Friesian Cows:				
No. 37 ...	5,232	531	3.6	4.1
No. 42 ...	5,017	354	3.9	3.9
Jersey x Montgomery Crosses:				
No. 66 ...	4,700	360	4.2	4.4
No. 63 ...	4,420	210	4.0	4.2
Indian Cows (locally-bred):				
No. 55 ...	1,963	274	4.5	4.9
No. 56 ...	1,519	279	4.3	4.6



Indian Cow. Local purchase.



Indian Cow. Local purchase.

Normally a cow giving a yield of less than 3,500 lbs. (350 gallons) in a lactation period not exceeding 350 days would be discarded from the herd as a poor milker, but until the size of the herd is substantially increased, this policy cannot be adopted.

Grooming and Spraying the Livestock.

Most European breeds of cattle in the tropics appear to retain the cold climate characteristic of growing a heavy winter coat. Periodic clipping of the hair is therefore a great relief to such animals during hot weather and facilitates the destruction of ticks. The long hair makes excellent cover for these parasites and affords protection against poisonous sprays applied to destroy them.

The fine hair of the Jerseys, in comparison to the rough coats of the Friesians, makes them more suitable in this respect for the tropics.

For keeping the hair of stock short a hand-power flexible shaft-drive clipping machine, as commonly used for horses, has been employed with success on the farm.

With regard to the control of ticks, the policy at Serdang is to spray all animals with an arsenical cattle dip once a week. In addition, any casual ticks which may gain access to the stock in the interval between spraying operations are removed by hand-picking during grooming.

Health of the Stock.

While the general health of both the locally-bred and imported Indian animals has so far proved satisfactory, that of the various imported European breeds has been indifferent in spite of the greatest care in housing, handling and feeding.

The Indian breeds are apparently immune to Red Water Fever (Piroplasmosis) caused indirectly by the incidence of ticks, but imported cows of the European breeds are very susceptible to it; the bulls, on the other hand, once they are acclimatised, appear to resist infection.

The following brief account of the behaviour of the various importations of European breeds under conditions obtaining on the plains at Serdang is of interest in this connexion.

(1) *Ayrshire Cows from Australia.*—The two grade Ayrshire cows, with calves at foot, transferred from Johore in June, 1928, never appeared to be in a normal state of health at Serdang. One cow succumbed to Pneumonia in November, 1928, after being treated for Piroplasmosis and the second cow died of *Gastro enteritis* in May, 1929, which disease was associated with Piroplasmosis.

Owing to sickness of the dams, the calves from these two animals did not get a good start in life and were to some extent stunted. One of them contracted Pneumonia and died in May, 1932, while the second

animal proved to be sterile and therefore was sold for beef at the end of that year.

(2) *Friesian Bulls from Hong Kong.*—The two pure-bred Friesian bulls received from Hong Kong in October, 1929, were just over one year old when they arrived at Serdang. Both animals were received in good condition and to date have shown little sign of sickness. One of them suffered from a mild attack of Piroplasmosis shortly after arrival, but on being treated with intravenal injections of trypan blue, soon recovered its normal health.

(3) *Friesian Cows from Australia.*—The six pure-bred Friesian heifers introduced from Melbourne in June, 1930 proved a failure. On the other hand, it should be mentioned that all these animals were received in poor condition with the result that, in spite of every precaution being taken to keep them free from ticks, they all contracted Piroplasmosis within a few weeks of their arrival at Serdang, one of these animals dying from the disease; shortly afterwards a second animal contracted anthrax and died. During 1932, two other cows died of *Gastro enteritis,* probably as a result of general debility caused by Piroplasmosis, while another cow recently lost condition to such an extent that it had to be destroyed. The remaining cow and three heifers have remained moderately healthy since the initial attacks of tick fever, which probably immunised them to some extent against further infection.

The above results indicate the difficulty of keeping cows of the European breeds in satisfactory condition on the plains in Malaya. On the other hand, the bulls of such breeds, when regularly sprayed with arsenical cattle dip, are comparatively free from Piroplasmosis.

The apparent relative immunity to Piroplasmosis of the Indian breeds and of cross-bred animals, the progeny of Indian and European stock, is a great asset in the establishment of a dairy herd in the tropics. This, however, does not eliminate the need for constant attention to the eradication of ticks from both locally-bred and imported animals by spraying and grooming. If this is neglected, the general debility produced by tick infection weakens the animals and this renders them liable to contract various diseases common to cattle in the tropics.

Observations on Preliminary Breeding Trials.

Since the farm has only been in existence for a comparatively short period, there has obviously been insufficient time to obtain any very definite results on the breeding trials. In the meantime, however, successful first and second crosses have been obtained between Friesian and Montgomery breeds. It will be interesting to watch the performances of these animals, both as regards milk production and immunity from tick fever,

Mention may also be made of the Jersey x Montgomery cross-bred cows transferred from Fraser's Hill, since these animals have been apparently immune to Piroplasmosis. Although only two lactations have been completed to-date by these cows, it has been shown that the monthly yields of milk are high. One of the cross-bred cows has given a yield of 456 gallons of milk during a lactation period of twelve months.

The upgrading of the pure-bred Montgomery animals is being followed as far as the smallness of the herd permits.

Although considerable difficulty is experienced in inducing the Montgomery bulls to serve the pure-bred Friesian cows to obtain the Montgomery x Friesian cross-bred, there is little trouble in procuring the Friesian x Montgomery cross-bred, since the Friesian bulls are much more active than the sluggish Montgomery bulls.

In view of the apparent unsuitability of the lowland climate in Malaya to the pure-bred European types of cows as opposed to the bulls, the latter should always be employed for crossing with the Indian Montgomery cows in cases where cross-bred animals are desired. Apart from this factor, allowance must be made for the prepotency of the bull in transmitting to the offspring the high milk-yielding qualities inherent in the animal. Therefore, the offspring of a Friesian cow mated to a Montgomery bull is likely to have a lower milk yield than its dam, while the reverse cross should have the opposite effect. Similarly, a cross-bred Friesian-Montgomery bull would probably have a much greater influence on milk production of the progeny than a pure-bred Montgomery bull.

General.

Although the purpose of this experimental stock farm is primarily for carrying out research in animal husbandry, a careful study has been made of the production of high-grade milk. The modern methods of dairying adopted on the farm have shown that it is possible with Asiatic labour, properly supervised, to produce high-grade milk in the tropics.

In addition to the work already recorded, a not inconsiderable number of pure-bred and cross-bred bulls of the different breeds have been distributed throughout the country for the improvement of local livestock.

The writers acknowledge the useful work of Mr. N. Kanagaratnam, Stock Farm Assistant at Serdang, who has had detailed charge of the farm, also the services rendered by the Government Veterinary Surgeon, Selangor and his assistant, who have been of great assistance in the diagnosis and treatment of sick animals.

Reference.

(1) Manurial Experiments with Guinea Grass at Serdang. By V. R. Greenstreet and J. L. Greig, *Malayan Agricultural Journal,* Vol. XXI No. 11, November, 1933, p. 543.

PANCHANG BEDENA CONTROLLED DRAINAGE SCHEME

BY

J. L. MILLER,

Drainage and Irrigation Engineer, Telok Anson.

The area embraced by the above scheme consists of approximately 15,000 acres of the coastal flats in the sub-District of Sabak Bernam in the State of Selangor. It is bounded on the west by coconut estates, on the north by the Bernam River, on the south-east by a forest belt and *permatang** and on the south-west by the Straits of Malacca.

The scheme is one of "Controlled Drainage" and consists primarily of three main drains, the largest of which has a bottom width of 20 feet, running paralled to one another from north-east to south-west and discharging into the Straits of Malacca. The largest has also an outlet, at the north, into the Bernam River and is graded to fall both ways from the centre. All four outlets are gated and fitted with automatic tidal flaps on the outside, together with positive action sluice valves on the inside. In this way, not only is salt water prevented from entering the system, but the water inside the drains can be maintained at a constant level.

The area is protected from high tides on the sea side and from flooding from the Bernam River on the north by substantial peripheral bunds which are built up to 2 feet above the highest recorded tide level and have a top width of not less than 10 feet. The eastern extremity of the coastal bund is carried northwards to the point where the land rises to the *permatang**. The western side of the area is protected by the existing coconut estates, and a low bund with a top width of 6 feet is sufficient to give control of the ground water required for cultivation.

Discharging into the main drains and running at right angles to them are sixteen cross drains, each with a bottom width of 8 feet. Each cross drain has its own control gate so that the water level in any drain is independent of the water level in the main drain.

The spoil from these drains is utilized to form bunds parallel and adjacent to them which have the effect of making each strip of land between two such drains into a separately controlled drainage area. The bunds also serve the useful purpose of access paths.

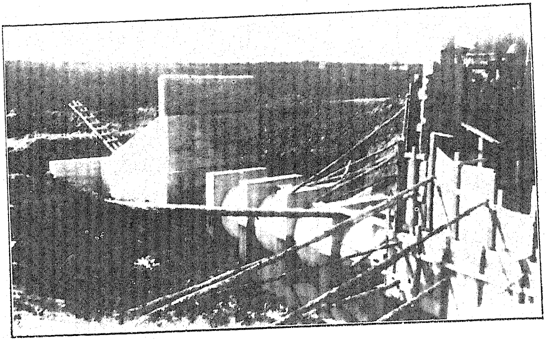
The drainage in the whole area is, therefore, completely under control. All gates can be opened to dry the land before harvest and in the padi-planting season, individual gates may be closed to retain in each particular section, sufficient water for cultivation.

The total lengths of main and subsidiary drains in the area are approximately 12½ miles and 45 miles respectively and the average area of each

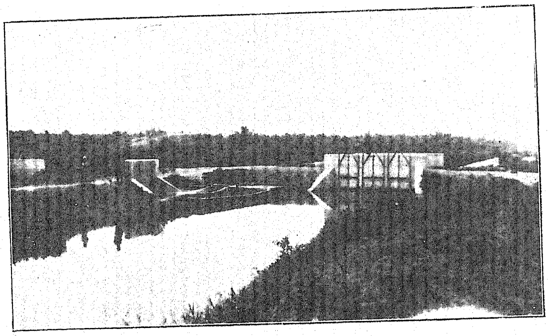
* Ridge of higher land, sometimes old sea-beach.

CROSS DRAIN A_2 D_4 BEING EXCAVATED.

BANJAREE COOLIES AT WORK ON CROSS DRAIN A_4 INDICATING THE NATURE OF THE WORK.



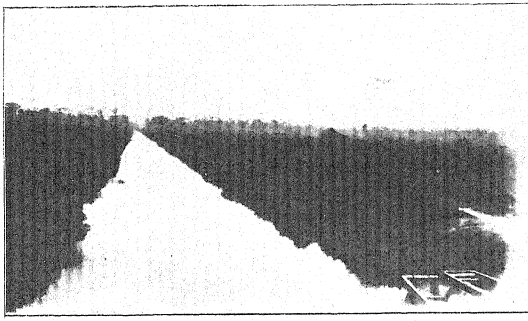
SUBSIDIARY CONTROL GATE ON A CROSS DRAIN UNDER CONSTRUCTION.



MAIN AND SUBSIDIARY CONTROL GATES, SUNGEI BESAR.

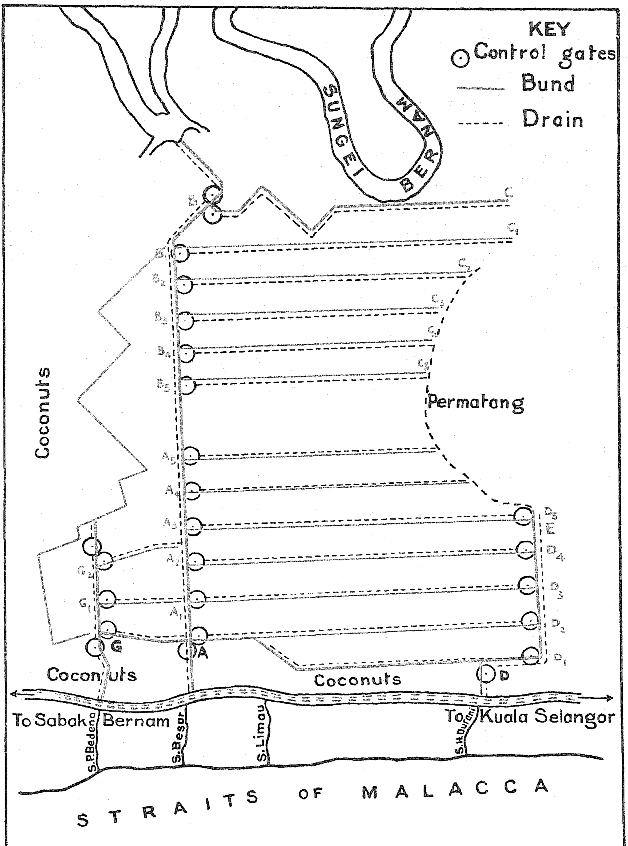
CONSTRUCTION OF CROSS DRAIN A_2 D_4 SHEWING NIBONG ROOTS ENCOUNTERED.

BANJAREE COOLIES WORKING UNDER DIFFICULTIES.



Part of the Main Drain from Sei Besar to the Bernam River after completion.

New opened up land.



SKETCH SHOWING DRAINAGE SYSTEM

PANCHANG BEDENA PADI AREA

controlled section is approximately 900 acres.

All control gates are of the long culvert type. The 42 inch diameter reinforced concrete pipes are laid on a concrete raft on a *bakau* foundation.

Progress of Work.

The work is now about two-thirds completed and is expected to be finished by the end of 1934. Jungle clearing for the drain reserves, gate construction and main and subsidiary drain excavation are being carried out in sequence and, as each successive subsidiary drain is completed, a further controlled area becomes available for cultivation.

It is estimated that 6,000 or 7,000 acres have already been felled of jungle and are under padi at the time of writing. The control of the water levels in the completed sections is proving quite successful.

The rapidity with which the land is being occupied is exceedingly gratifying. In the initial stages, the work of felling and opening up went ahead of the control works. This fact is interesting in view of the gloomy fears expressed in some quarters that colonisation of new rice lands will be a failure.

Colonisation, though difficult, has up to the present presented no insuperable obstacles in spite of the fact that the activities of the Drainage and Irrigation Department have already resulted in the provision of new padi lands up to a total of nearly half the area of the lands watered by the Krian Irrigation Works.

The geographical position and topographical nature of the land have been the two factors governing the work of construction. Access, either by land or sea, was (and still is) difficult and conditions of life in no way help to retain labour which has been attracted to the area.

Parts of the jungle which covered the area contained an unusually large proportion of nibong (*Oncosperma filamentosa*, Bl.) the poisonous spikes of which hindered the work of clearing, while the roots proved an equal hindrance during earthwork.

While the uniform flatness of the ground is ideal from the padi cultivators' point of view, it was unpleasant to find that the jungle held up standing water throughout the year. Jungle clearing and burning for the drain reserves was therefore difficult. Drain excavation was carried on rapidly during the dry season but, in wet weather, the actual rainfall, added to the heavy run off from the newly opened areas, made conditions extremely unpleasant. Two of the accompanying photographs give a good idea of working conditions.

Work of a good standard is, however, being carried out at low rates and the cost of the scheme is expected to be between $16 and $17 per acre.

CONDITIONS ON SMALL RUBBER HOLDINGS IN MALAYA.

1st Quarter 1934.

Prepared by the Economics Branch of the Department of Agriculture, S.S. and F.M.S. in collaboration with the Field Branch of the Department of Agriculture.

Rainfall.

The month of January was characterised by an unusual period of wet weather, giving a rainfall much above the average in all parts of the Peninsula except in the State of Kedah and Kelantan and a few other localities including Cameron Highlands. The wet period occurred generally during the first fifteen days to three weeks of the month, but in Krian and Larut Districts of Perak and on Cameron Highlands the middle ten days constituted the wet period. While Krian and Larut Districts experienced a heavy rainfall, minor floods occurred in Pahang and more severe floods in Johore and Singapore Island. During February in Pahang and Selangor warm dry weather was interrupted by fairly frequent thunderstorms and high winds; in Negri Sembilan, Malacca and Johore, warm dry weather prevailed. In Kelantan and in Singapore Island the first half of the month was cool and showery, while the second half was warm and dry. Conditions during March were nearly normal in Kedah and Kelantan, though the rainfall was somewhat below the average and in the eastern State the second half of the month was hot and dry. The rainfall was much above average in the southern part of the Peninsula, from Negri Sembilan to Singapore Island, being especially heavy in the first half of the month when floods occurred in Johore and Singapore Island.

Prices.

Table I which is appended shows the ruling prices for the period January to March 1934 for small holders' rubber, and it will be noted that there has been a further increase in price as compared with the 4th. quarter of 1933.

Table II.
Average Singapore Prices for Small-holder's Rubber.

	Smoked Sheet $	Unsmoked Sheet $	Scrap $
January	19.00	17.50	6.00
February	20.00	18.50	8.50
March	22.00	20.50	7.50

Table I.

Rubber Prices [in Straits dollars per picul ($133\frac{1}{3}$ lbs.)]

1st Quarter, 1934.

	Singapore standard sheet Average	Singapore for small holder's rubber at end of month	Penang for small holder's rubber	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Province Wellesley	Kedah	Johore (Av: of 10 centres)
JANUARY											
Smoked sheet.	19.32	19.00	—	13.50-18.75	14.00-19.50	14.00-18 65	10.00-19.90	16.00-17.00	16.00-18.00	14.50-19.50	14.00-16.50
Unsmoked sheet.		17.50	13.50-16.50	11.00-16.00	12.00-17.50	10.00-16.50	8.00-16.50	10.00-15.00	14.00-16.50	12.50-17.00	12.30-13.67
Scrap		6.00	4.00-7.00	3.00-6 50	3.00-7.00	2.00-6.00	3.00-6.50	4.00-6.00	5.00-6.00	4.00-7.00	4.00-5.00
FEBRUARY											
Smoked sheet	21.66	20.00	—	14.00-21.50	17.00-22.00	17.00-21.60	15.00-21.50	20.00-21.00	20.00-21.50	15.00-21.00	17.35-18.86
Unsmoked sheet		18.50	15.00-20.50	14.00-19.50	15.00-20.75	15.00-20.00	8.20-20.00	14.00-19.00	18.00-20.00	13.50-18.00	14.66-18.00
Scrap		8.50	5.00-8.00	2.50-9.00	4.00-8.00	4.00-8.00	3.00-8.00	5.00-9.00	7.00-8.00	5.00-8.00	4.25-5.91
MARCH											
Smoked sheet.	22.77	22.00	—	18.50-23.00	19.00-23.80	19.00-23.00	17.20-23.00	21.00-22 50	20.00-23.00	18.00-24.00	19.36-21.90
Unsmoked sheet.		20.50	19.00-22.50	16.00-22.00	14.00-21.50	15.00-20.25	13.00-20.00	16.00-21.00	17.00-21.00	17.00-22.00	17.00-19.80
Scrap		7.50	7.50-9.00	3.00-8.50	4.50-10.00	4.00-9.00	4.00-8.00	5.00-9.50	7.00-9.50	6.00-8.50	5.00-6.00

The quotations in the Table show the ruling prices from a large number of buying centres. Factors such as transport and local competition affect the prices secured by the small-holder for his rubber.

Table II shows the trend of average prices ruling in Singapore per picul at the end of each month for *Kampong* rubber.

Tapping.

Reports from Negri Sembilan state that tapping systems remain substantially unaltered, extreme cases of excessive excision have been noted, as also has the use of ladders; these, however, are not common. Several holdings, the extent of which have not as yet been determined, are reported to have been newly opened up in the Coast District, but no areas of immature trees have been noted in production. As the price of rubber improved, many holdings in Selangor and other States were brought back into tapping, whilst no cessation of tapping was noted during the wintering period. In Malacca tapping continued to be heavy, opening of high panels, necessitating the use of ladders being quite a common practice. Reports from Penang and Province Wellesley state that tapping has been extremely active and that no abatement was observed during the wintering season, whilst in Kedah heavy tapping was continued throughout the quarter. In some districts in Perak, holdings have been cleaned up and tapping re-commenced. The area of untapped rubber is now low. Pahang reports state that a fairly considerable area of young rubber has been brought into tapping. The tapping generally is good but in some cases over-tapping has been practised.

Areas out of Tapping on Small Holdings.

The method of estimating the area untapped among small-holdings by means of counting the number of such holdings along the sides of main roads was again employed, the result of this computation is shewn in Table III and was applied to the known area of tappable rubber, 1927 planting and earlier.

The total area of tappable rubber on estates of less than 100 acres which was untapped in the Federated Malay States at the end of March 1934 is estimated on the foregoing system as amounting to approximately 34,950 acres as compared with 45,000 acres at the end of December 1933. The total area untapped in the Straits Settlements at the end of March 1934 is estimated to be 9,900 acres as compared with 14,000 acres at the end of December 1933.

Diseases.

Mouldy Rot.—Weather conditions favoured the spread of mouldy rot throughout Negri Sembilan during January. With a considerably reduced rainfall during February, the disease rapidly diminished and despite the fairly wet conditions of March, the situation at the end of the quarter was satisfactory. Reports from Selangor state that the disease was well under control during

the quarter, and similar reports were received in regard to the Settlement of Malacca. There was little to record regarding mouldy rot disease in the State of Kedah but the distribution of disinfectant was continued and was considerable. Perak reports state that mouldy rot was the only disease of real importance during the quarter. The increase in price of the commodity has resulted in painting being given somewhat more attention, but on the other hand, wet weather resulted in greater virulence of the disease. Departmental sales of an approved fungicide were not large, but many owners of rubber land purchase their requirements from local vendors. Tar remains a very common painting material in most localities. In Pahang, however, the sale of disinfectant has proved very popular. Towards the end of the quarter, the disease was again well under control.

Oidium Leaf Disease.—In the State of Negri Sembilan, 16 estates notified the presence of *Oidium Heveae* after the commencement of wintering, whilst in Selangor only one outbreak was reported. Reports from Malacca state that *Oidium Heveae* occurred in the usual areas, outbreaks of this disease also occurred on Central and South Kedah, but these were not severe and by the end of the quarter, following good rains, the attacks had almost disappeared.

Grades of Rubber Made.

Figures of the percentages of the various grades of rubber produced, where these have been recorded, are as follows:—Penang and Province Wellesley: (figures from 26 dealers) smoked sheet 17, unsmoked 66, scrap 17.

Kedah:—smoked sheet 48, unsmoked sheet 19, scrap 33.
Malacca:—smoked sheet 15, unsmoked sheet 64, scrap 21.
Selangor:—smoked sheet 80, unsmoked sheet 1, scrap 19.
Perak: Taiping:—smoked sheet 32, unsmoked sheet 50, scrap 18.
Kuala Kangsar:—smoked sheet 30, unsmoked sheet 41, scrap 29.
Larut and Matang:—smoked sheet 1, unsmoked sheet 78, scrap 21.
Selama:—smoked sheet 80, unsmoked sheet 15, scrap 5.
Johore: Muar:—smoked sheet 32, unsmoked sheet 58, scrap 10.
Batu Pahat:—smoked sheet 81.5, unsmoked sheet nil, scrap 18.5.
Tangkak:—smoked sheet 50, unsmoked sheet 35, scrap 15.
Pontian:—smoked sheet 5, unsmoked sheet 80, scrap 15.
Johore Bahru:—smoked sheet 25, unsmoked sheet 48, scrap 27.
Kota Tinggi:—smoked sheet 15, unsmoked sheet 60, scrap 25.

Table III.

Estimated Acreage of Tappable Rubber which was out of Tapping on Holdings of less than 100 Acres, at the end of March, 1934.

PERAK

District	Total Tappable area	Total area untapped	Percentage
Batang Padang	37,288	750	2
Kinta	34,180	1,600	5
Kuala Kangsar	43,485	2,200	5
Upper Perak	13,774	1,500	11
Larut & Selama	51,407	3,100	6
Krian	9,751	4,200	43
Lower Perak	47,937	2,400	5
	237,822	15,750	7

SELANGOR

District	Total Tappable area	Total area untapped	Percentage
Klang	18,879	2,300	12
Kuala Langat	29,263	1,200	4
Ulu Langat	38,867	400	1
Ulu Selangor	30,632	2,100	7
Kuala Lumpur	21,174	1,500†	5†
Kuala Selangor	9,379		
	148,194	7,500	5

NEGRI SEMBILAN

District	Total Tappable area	Total area untapped	Percentage
Seremban	19,241	1,200	6
Tampin	17,947	1,300	7
Kuala Pilah	17,470	1,900	11
Jelebu	6,270	200	3
Port Dickson	10,653	1,000	9
	71,581	5,600	8

PAHANG

District	Total Tappable area	Total area untapped	Percentage
Raub	7,361	1,200	16
Kuala Lipis	15,951	300	2
Bentong	13 600	1,800	13
Other Districts	31,223	2,800	9
	68,135	6,100	9

MALACCA

District	Total Tappable area	Total area untapped	Percentage
Central	17,687	1,400	8
Alor Gajah	31,387	5,000	16
Jasin	24,971	500	2
	74,045	6,900	9

PENANG & P. WELLESLEY

District	Total Tappable area	Total area untapped	Percentage
North	3,241	100	2
Central	7,067	800	12
South	8,149	—	—
Dindings	7,279	900	12
Penang	11,114	200	2
	36,850	2,000	5

SINGAPORE

District	Total Tappable area	Total area untapped	Percentage
Singapore	12,781	1,000	8
	12,781	1,000	8

The percentage of areas out of tapping in December, 1933, was as follows:—Perak 6, Selangor 11 the Negri Sembilan 12, Pahang 10, Malacca 14, Penang and Province Wellesley 5, Singapore 15.

* Estimated from same percentage as shown in Kuala Kangsar District.

† Estimated from mean percentage for remainder of State.

Reviews.

The Giant Snail in Batavia.

An article by S. Leefmans in *Landbouw* of December 1933 entitled "Preliminary Report on the Control of Achatina in Batavia" deals briefly with the steps taken in Netherlands India to control this pest.*

Damage was conspicuous only on banana leaves, though damage to flowering and ornamental plants is also noted. More extensive damage to vegetable gardens was prevented, it is claimed, by the measures taken before the pest had increased sufficiently as to prove a menace.

The snails feed on human and animal excreta, and will also enter buildings in search of lime. It is feared that the snails may spread to estates where they may multiply rapidly and become a serious pest.

In one large centre a campaign was organised to collect the snails. More than two million were caught and destroyed.

Two large centres in Batavia were cleared of snails by collection and by chemical measures. After clearing the growth, the infested area was sprayed with 4 per cent. copper sulphate. Furthermore, hedges and walls in the neighbourhood were white-washed with calcium arsenate. The snails have a real lime-hunger and so can easily be poisoned. These two areas are now totally free of snails.

As calcium arsenate is easily washed away from walls and trees by tropical rains, it is incorporated with lime and cement, of which mixture small lumps are prepared. These lumps are put in heaps in the infested area and if the snails feed on them they die within four days.

The method of poisoning described in this article is worthy of trial in Malaya. The use of copper sulphate in this connexion is well known and has met with some success in Malaya. Hand collection has been tried on a large scale, especially in Johore, but has not met with conspicuous success. Poisoning with calcium arsenate stones coupled with clearing up all possible breeding places should be an effective measure of control.

D. H. G.

Rubber Research Institute of Malaya Information Cards.

The Rubber Research Institute has published a series of seven Information Cards, suitable for desk or wall use, dealing with the manufacture of rubber. The titles are :—Standardisation and Coagulation, Some Estate Chemicals and their Uses, Defects in Rubber (two cards), Preservation of Latex for Export, Testing Preserved Latex, Useful Information. The set is contained in a folder and published at 50 cents in Malaya and $1 outside this country.

By reason of the concise method of presentation and the valuable information, rubber estate managers will find these cards a useful addition to the office table.

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* See also Review of another paper on this subject by the same author and another, published in the *Malayan Agricultural Journal* Vol. XXI No. 11, November 1933.

Abstracts

DERRIS ROOT AS A NETHERLANDS INDIA EXPORT PRODUCT.*

Substances used for the purpose of killing insect pests may conveniently be classified as (i) inorganic poisons, such as compositions of lead, copper, arsenic, sulphur, selenium; (ii) organic poisons, such as nicotine, thiocyanate, pyrethrum and derris extracts and (iii) petroleum compounds.

The use of many inorganic poisons, when applied to plants intended for consumption as food, involves risk of poisoning to mankind and animals.

To avoid the absorption by the human system of poisonous insecticide substances, a more direct method is being sought; at present the endeavour is to find insecticides which exercise a more specific action upon the insects and that will present no dangers to man.

However, just as there exists no panacea for all maladies and complaints, so there is no universal insecticide that can fight the very large number of noxious insect varieties in a practical and successful manner; so that the above-mentioned injurious insecticide substances will undoubtedly be retained in their proper places, although it is the intention to limit their use as greatly as possible and substitute for them insecticides not dangerous to the human system.

A good deal of attention has been paid to nicotine which, though a poisonous substance, might be less dangerous than are the inorganic insecticides. But both in the application of this chemical and in the consumption of products on which it is applied, cases of nicotine poisoning have been reported.

Extracts of pyrethrum have been tried, and also different varieties of derris and cubé roots, the active principle thereof being rotenone. It has been found that not only are such extracts practically non-poisonous to men and animals, but also that chiefly the extract of derris, or rather the rotenone, is much more destructive to a good many noxious insects than are the inorganic insecticides and nicotine. Poisonous action upon useful insects is but slight, seeing that derris insecticides retain their toxicity, once they have been sprayed upon the plants, for only a short time—which, however, in itself constitutes an objection to its application. To birds these and the pyrethrum compounds are harmless. For human beings rotenone, even in fairly considerable quantities, is without noxious effects. It is for this reason that such combination is employed in fighting exo-parasites of animals, as in cattle dips, and favourable results have also been observed in their effect on endo-parasites. In addition, rotenone can be used with considerable success to keep woollen articles moth-free.

The difficulty that rotenone, under the influence of direct sunlight, rapidly oxidises into inactive derivatives has been counteracted by adding soot to the liquid to be sprayed. But it has been found that dihydro-rotenone prepared

* Abstract and Review of an article by D. R. Koolhaas in the *Economic Bulletin of Netherlands India* Vol. I, No. 3, February 16th, 1934.

from rotenone through reduction according to a process analogous to the hardening of fatty substances, has at least the same insecticidal properties as has rotenone itself, and is more resistant to the influence of air and light.

Besides rotenone there are to be found in derris other substances with insecticidal properties, namely, degueline, tephrosine and toxicarol.

In some cases, rotenone is a stronger insecticide than is pyrethrum extract, which is its closest competitor.

Originally, an extract of derris root made by means of water and diluted with soapy water, was used as a direct insecticide. On account of the facts that a total extraction of poisonous substances was not readily effected by this method, that such extracts cannot be kept good without the addition of preservatives and also because the roots vary greatly as regards their poison contents, this method was found to be unreliable. Seeing that the rotenone is very much more poisonous to insects than are the other combinations present in the root, *Roark* suggested that the rotenone content is the only method by which to judge the value of the roots.

This is all the more important in view of the fact that various firms market not only a total extract from derris root, but also more or less pure rotenone.

Roots that have a content of less than 3 per cent. can be discarded when rotenone is to be prepared. The exporters of the root, whether it be a forest product or an estate-grown product, can demand a higher price if the rotenone content is in excess of the normal. *Roark* states that if planters will not supply derris root having a guaranteed rotenone content, it is very probable that the consumers will purchase cubé roots from Peru and Brazil.

This requirement is especially of importance in the case of the Netherlands India product, as it has a somewhat unsatisfactory reputation in this respect. Based on analyses of derris root samples from the forests of Western Java, it is concluded that this bad reputation is, generally speaking, unmerited, or at least unnecessary.

Information is given regarding derris cultivation, selection of stock and age at which the plant should be harvested. Methods of distinguishing good forest-grown derris roots from the useless parts of the plants are indicated. Deliberate substitution of other roots, which may occur in the forest-grown derris, is a reason for preferring the cultivated product.

The article states (on page 388) that in Malaya there is a derris estate at 1425 metres above sea level. This is inaccurate. Derris is not being grown as an estate crop in Malaya at this elevation. There may be small areas at this elevation, but not an estate.

Mention is made of other plants containing rotenone. At present, however, the only plant of importance besides derris, as a source of rotenone is *Lonchocarpus nicou* or cubé from South America. Commercial samples, 23 in number, which were analysed, shewed a rotenone content varying between 0.8 and 11.2 per cent., representing an average of 5.4 per cent. and a close

relation between the ether extract and the rotenone content. Derris is regarded as of more importance as an insecticide as it contains a higher proportion of other substances that have the same effect as rotenone.

It is considered that the use of rotenone-containing roots for insecticidal purposes will certainly increase in years to come. The use of pyrethrum is already fairly extensive, but in view of the manner in which derris is advertised and recommended, especially by the Government of the United States of America, its more extensive use may fairly be predicted, to the lesser employment of other insecticides, including perhaps pyrethrum. Also, a combination of derris and pyrethrum seems to result in a very useful insecticide, the application of which may prove to become even more general than that of either separately.

London prices of derris root in 1933 are stated, followed by brief information of packing for export and on sampling for analysis.

As it is very probable that derris, for certain soils and under definite conditions, especially when high-grade clones are planted, opens up possibilities for a paying cultivation, either as a sole or as a mixed cultivation, it will not appear strange that this plant, for some time past, has attracted a good deal of interested attention on the part of the various institutions connected with the Department of Economic Affairs in Netherlands India. Endeavours are now being made to obtain high-grade clones that can be used for planting, whilst the investigation of wild varieties and forms is being actively continued so as to assist the exporters of the forest product by supplying them with accurate information, and in order to have available in as short a period as possible, a considerable quantity of good planting material.

Note :—The above Abstract is published in this place to draw attention to the interest in derris evinced in Netherlands India. At the same time, the Department of Agriculture, Straits Settlements and Federated Malay States, does not necessarily agree with the views on the chemistry of the toxic substances put forward in this article. In particular, it is not yet admitted that there is conclusive evidence shewing that rotenone is the most active or most important toxic constituent in derris root. Work on this and other points is actively in progress in the Department. Naturally, the question of which, precisely, is the most important constituent does not affect the value of the root as a whole.—*Editor.*

SEVENTEENTH REPORT ON THE NATIVE RUBBER CULTIVATION

Fourth Quarter, 1933.

Prepared by the Bureau of Agricultural Economics of the Agriculture and Fisheries Service of the Netherland Indian Department of Affairs at Batavia, Java. G. Kolff & Co., Batavia. February 1934.

Prices.

During the first four months of 1933, the price of standard sheet rubber at Batavia averaged 7 guilder cents per ½ kg., after which, as a result of the economic measures taken in the United States of America, and a little later supported by the restriction negotiations, there was a firm price improvement, the price level rising to 12 guilder cents, and in November and December to 13 and 13¾ cents. The quotations for "blanket" followed this rise somewhat irregularly and less definitely: up to and including July, "blanket" prices remained at an average of 80 per cent. of the standard sheet quotations, after which this relation became modified to the disadvantage of the "blanket" article, amounting in the months of September 1933 to January 1934, inclusive, to 71 per cent., 65.6 per cent., 66.2 per cent., 67.4 per cent., and 70.4 per cent. thereof, respectively, this being the outcome, probably, of the relatively greater increase of "blanket" production in relation to "sheet" production, causing the former to be absorbed by the market at lower prices.

Exports.

The exports of the native rubber from Netherlands India sharply reacted to this price increase: quarterly exports of native rubber in net metric tons were:—13,420; 25,597; 36,687; 38,954 respectively. The total exports of rubber from the Outer Provinces in 1933 were 116,158 tons, which is a record. The increased exports, especially in the second half of the year, are attributed in part to the gradually increasing world price level and to labour becoming available upon the conclusion of the season's agricultural activities.

Local reports clearly indicate that, despite this high export figure, as yet less than one half of the tappable trees are in exploitation.

Labour.

Even now, hardly any outside labour is being used for tapping; it is done mostly by means of family labour with the assistance of local forces paid in production. Rubber cultivation in all Provinces still remains a secondary

occupation to food-crop production and this condition can only be looked upon as a satisfactory state of affairs.

The production increase in 1933 over 1932 is almost entirely represented by the group "wet slabs". The exports in metric tons (not in terms of dry rubber) of "rubber in cakes and slabs" during 1933 were 140,607 tons as compared with 67,655 tons in 1932.

Estate and "Native" Rubber.

A survey of the rubber exports from the principal centres of production is presented in a Table which indicates the very different reactions to the prevailing prices. The production of all groups since the second half of 1932 has increased, but in very varying degrees. Estate rubber reacted least of all, this product evidently not being able to adapt itself so readily to the circumstances brought about by the changeable prices as could the native cultivation. The strongest reaction, both to low and to high prices, is exhibited by the native production in Netherlands India, of which the export in the first six months of 1932 amounted to 48.3 per cent. only of that in the corresponding period of 1929, but increased to 143.8 per cent. in the second six months' period of 1933. The character of this cultivation as a secondary source of profit and the fact that a very considerable rubber-growing area is involved, makes it possible for it to react so acutely to world prices.

Local Reports.

Achin and Dependencies.—Despite activities connected with rice cultivation, rubber tapping increased, resulting in an export during the fourth quarter of the year of 165 tons as compared with 109 tons in the third quarter. It is estimated that at present about 30 per cent. of the tappable area is in production. Prices in Langsa in guilder cents per 100 kg. wet slabs were from f 6.20 to f 6.80 in October and for the last two months of the year around f 8.40.

Tapanoeli.—The exports from Sibolga amounted to 824 tons of dry rubber and, for the first time in 1933, of a small quantity of slabs. Local native market prices for first quality "Sheety crepe" varied between 14 and 15 guilder cents per kg. An improvement in quality is noted. Increased tapping applies to the older gardens and less to the younger and more distant holdings. The area at present being tapped is estimated to be from 40 to 50 per cent. of the total tappable area.

Sumatra West Coast.—Exports were 106 tons (dry equivalent) as compared with 60 tons in the third quarter. The recently-opened rubber mill at Padang worked up a considerable quantity of slabs into blanket rubber. Prices at Kota Baroe varied from f 4.50 to f 4.00 and at Bangkinang from f 2.30 to f 3.20. Although a number of gardens were cleaned up, considerable areas remain untapped.

Palembang.—During the quarter 5,660 metric tons were exported as against 4,982 tons during the third quarter of the year. December exports are exceptionally high at 2197 metric tons, attributable to completion of other work on

native holdings, demand for cash for approaching "Lebaran" festivities and to high market prices for rubber. At present prices further increased production is anticipated. In January 1934, 3371 metric tons of wet rubber was shipped from Palembang as compared with 3160 tons in the preceding month.

Djambi.—Exports increased considerably, being 8,492 metric tons in the last quarter compared with 6931 in the third quarter, 5170 tons in the second quarter and 3792 tons in the first quarter.

Increased production is attributed to favourable price, demand for cash and favourable weather conditions for tapping.

Riouw and Dependencies.—From the mainland 2706 tons (in terms of dry rubber) were exported and 577 tons from islands. Figures for the preceding quarter were 2528 and 326 tons respectively. The holdings in the islands are mostly owned by Chinese who are working with local or imported labour. In the sub-division of Lingga, sheet rubber was about 7 guilder cents per kati in the third quarter and 8 cents in the fourth quarter. Buyers and exporters are Chinese. Freight to Singapore is estimated by them at about $1 per picul.

Banka and Dependencies.—265 tons were exported from Banka, 218 of which consisted of sheet rubber and 41 tons of slabs, figured in dry equivalent. Export of sheet rubber increased considerably in the second half of the year. In the course of but a few months dozens of rubber mangles have been imported, the Chinese owners hiring them to rubber tappers. The sheets weigh from 1—1½ kati and are sometimes of good quality. Sheets of lower quality are again worked up in Singapore into blanket rubber, whilst the better sheets receive no further treatment.

Western Division of Borneo.—Exports in the fourth quarter amounted to 7,260 tons dry equivalent as compared with 8,226 tons in the third quarter. The decline is attributed to seasonal agricultural activities and to wet monsoon weather which reduced the number of tapping days. It also appears that Chinese are keeping back considerable quantities of rubber. Prices in Pontianak, in guilders per picul, varied from f 4.00 to f 5.50 in October; f 4.60 to f 6.50 in November and f 4.00 to f 6.25 in December. In the quarter under review there were still important areas left untapped.

Southern and Eastern Division of Borneo.—Exports fell from 8,386 tons dry equivalent in the third quarter to 6,988 tons in the fourth quarter. This decline is attributed to the rice harvesting and planting activities. It is likely that a higher export figure will be reached in January 1934.

The price per 100 kg. of wet and dry slab at different centres is stated. As an example of the price movement: at Kandangan wet slab was f 4.20 in October and f 5.20 in the latter part of December, while dry slabs varied from f 7.50 to f 7 in October to f 8.50 in December.

Miscellaneous.

BALIK PULAU, PENANG, AGRICULTURAL SHOW.

The third Balik Pulau Agricultural Show was held on March 30th. and 31st. and April 1st. The last Show in this District was in 1927.

Prizes were awarded for 162 classes, arranged under 9 sections.

The first phase of the Malayan Agri-Horticultural Association Padi Competition was run in connexion with the local padi competition, the best three samples, which were of extremely high quality, being selected for subsequent despatch to the Malayan Exhibition at Kuala Lumpur.

With the exception of fruits, most of which were out of season, all classes were well represented.

The Department of Agriculture staged special exhibits of an instructive nature on mushroom cultivation, the etiolation method of propagating fruit trees, the production of improved copra, and on rat destruction.

The Chairman of the Committee, Mr. A. V. Aston, and those associated with him in this event, are to be congratulated on a most successful show, which it is hoped, will now become an annual affair.

MEETING OF THE AGRICULTURAL ADVISORY COMMITTEE.

A meeting of the Agricultural Advisory Committee of the Department of Agriculture, S.S. and F.M.S. was held at Kuala Lumpur on 14th March, 1934. The Hon'ble the Director of Agriculture was in the Chair. The following are among the more important subjects discussed.

The Coconut Industry.

A resolution for transmission to the Malayan Governments was drawn up as follows:—

"The Advisory Committee of the Department of Agriculture desires to draw the attention of the various Malayan Governments to the present precarious position of the coconut industry and that of other oil crops in this country.

"It considers that the outlook for these industries is extremely grave and it suggests that, especially in view of the large areas cultivated under these crops by small-holders, the matter must be one of serious concern to Government.

"The Committee suggests for the consideration of the Malayan Governments that a useful purpose would be served if His Excellency would appoint a Commission to make full enquiry into the circumstances of the coconut and other vegetable oil producing industries in Malaya with a view to reporting thereon to the Malayan Governments.

"The Committee desires to add that it has had represented to it that, apart from the general disabilities under which these industries are labouring owing to the world economic situation, the copra industry is in particular suffering from unfavourable discrimination by shipping companies in the matter of freight. It suggests that, in the interests of the industry in general and of the small-holders in particular, the position in this respect may be such as to call for special action if this is feasible." (See note on appointment of Committee to investigate Malayan Oil Producing Industries).

The Pineapple Industry.

The meeting was informed that the bill for establishing legislation in regard to the pineapple industry had passed its third reading in the Legislative Council and that steps are being taken to introduce similar legislation in Selangor and Johore. It was agreed that, in order to institute uniformity, legislation in the two latter States should include a clause, similar to that embodied in the S.S. Ordinance, for the establishment of an Advisory Committee which can assist in securing co-ordination in all the administrative areas concerned, and further, that the personnel of this Committee should be identical for these three areas.

The meeting was informed that draft rules and standards for grading canned pineapples has been drawn up and submitted for comments to the various representatives of the trade.

The Chairman reported that a first trial shipment of 88 cases of graded pineapples had been despatched from Singapore with the object of introducing officially graded fruit to the notice of the trade at home.

Report on Coffee Samples from Tanah Rata.

The Committee was informed that the latest report received showed a definite improvement on preceding reports on the samples sent to London and that it is hoped very shortly to better the conditions of manufacture by the addition of new machinery on Cameron Highlands.

Farm Schools at Malacca and Singapore.

The Chairman reported that the proposals for a Farm School at Malacca have been approved by the Resident Councillor, Malacca; they have been referred to the Malacca Committee of the Council and if they are finally agreed upon, the work will be proceeded with during the current year. He stated that similar proposals for the establishment of a school at Singapore had been provisionally approved by the Governor in Executive Council and would be proceeded with this year if the Legislative Council agreed to vote the money.

Mouldy Rot Disease of Rubber.

The Chairman reports that the scheme for distribution to kampong owners of cheap Izal for the treatment of mouldy rot is working very well in Selangor, Negri Sembilan, Pahang, Penang and Province Wellesley, Kedah and in parts

of Perak, and that arrangements are being made for its inception in other States and Settlements.

Among other subjects discussed at the meeting were :—poultry; tea experiments on Cameron Highlands; development of the rice industry; marketing of Malayan bananas; research work on copra; and home garden competitions.

COMMITTEE TO INVESTIGATE MALAYAN OIL-PRODUCING INDUSTRIES.

H. E. The High Commissioner has appointed a Committee consisting of The Hon'ble the Director of Agriculture (Chairman); The Hon'ble the Raja Muda of Perak, M.F.C.; The Director of Co-operation, F.M.S. and S.S.; Mr. J. C. Innes, Manager of the Penang Rubber Estates Co., Ltd., as the S.S. member; Y. M. Ungku Abdul Aziz bin Abdul Majid, as the representative of Johore and Mr. F. C. Cooke (Secretary) with the following terms of reference :—

> "To investigate and report on the present economic condition of the coconut and other vegetable oil producing industries in Malaya and to make recommendations."

AGRICULTURAL SHOWS, 1934.

Balik Pulau, Penang	March 30th. to April 1st.
Kota Bharu, Kelantan	April 19th.
Bukit Mertajam, Province Wellesley	April 20th. and 21st.
Teluk Anson, Perak	April 28th.
Temerloh, Pahang	May 19th.
ELEVENTH MALAYAN EXHIBITION, KUALA LUMPUR	June 2nd. to 4th.
Kuala Selangor, Selangor	August 4th.

Agricultural Shows are also being arranged at the following centres on dates yet to be fixed :—Kajang, Sabak Bernam and Kuala Langat in Selangor, Bentong in Pahang (in August), Mersing in Johore (about June).

In addition to the above, Padi Shows will be held at 46 centres before the Malayan Exhibition, the winning exhibits of each being despatched to the latter Exhibition for further competition.

CORRECTION.

Reference to the article on "A Major Pest of *Derris*" published in the *Malayan Agricultural Journal,* Volume XVIII, No. 11, 1930.

The insect dealt with therein, provisionally determined as *Neolepta biplagiata* Jacoby, has since been described as a new species, the name being *Craniotectus corbetti* Laboissière.

The publication in which this species is described is the "Annales de l'Association des Naturalistes, Levallois-Perret, 20 (1914-31) 1932, pp. 140, 141.

Departmental.

FROM THE DISTRICTS.

The Weather.

April was a normally wet month in most parts of the Peninsula, with a rainfall about or rather above the average. At Cameron Highlands, however, the rainfall was very much in excess of the average for the past five years. In contrast to the generally prevailing conditions, the weather was unusually dry at Lumut in the Dindings, Sitiawan on the Perak coast, along the west coast in Malacca and Johore, and in Singapore island; while on the east coast of Johore and in the Pekan and Temerloh Districts of Pahang, the rainfall was below the average for the month.

Remarks on Crops.

Rubber.—Reports of an international agreement for the restriction of rubber production and their confirmation at the end of the month caused a further rise in prices. The lowest and highest prices in dollars and cents per picul recorded for rubber from small holdings were:—Smoked Sheet \$19.20 to \$25.50; Unsmoked Sheet \$16 to \$25; Scrap \$4 to \$12. The Singapore prices for these grades were \$25.50, \$23.50 and \$9.50 as compared with \$22, \$20.50 and \$7.50 in March. Penang prices for Unsmoked Sheet ranged from \$20.50 to \$24 as compared with \$19 to \$22.50 in March.

As was to be expected, the rise in price has resulted in bringing back into tapping almost all the holdings on which the trees are of tappable age. References are made to excessive tapping in some localities, while from Johore and eastern Pahang it is reported that tapping is often done by unskilled women and children with consequent damage to the trees. The use of ladders to give access to tappable bark has been observed in a number of instances in Negri Sembilan.

Leaf mildew on trees just recovering from wintering continued to be fairly widespread in the localities mentioned in last month's report, but was prevented from doing serious damage by the prevailing wet weather. Treatment of bark diseases, especially mouldy rot, continued to improve as also did the general upkeep of small holdings.

Padi.—The price of padi at the Government Rice Mill, Bagan Serai, remained at \$1.40 per picul, while private buyers paid \$1.20 to \$1.30 per picul. The price in Kedah declined and was equivalent to approximately 90 cents to \$1 per picul in Kota Star District, while in the Province the range was from about \$1 to \$1.35 per picul.

The padi harvest has been completed, except in the Sabak Bernam sub-District of Selangor and Kuantan District of Pahang, where reaping was in progress throughout the month. The Krian crop is the best obtained during

the last decade, being roughly estimated at 18 million gantangs. The Bagan Serai mill has already purchased some 12,000 tons of padi. The crops in Kedah and Province Wellesley are known to be very good. In Malacca some 32,250 acres planted yielded 12,360,000 gantangs of padi, a satisfactory feature being the small proportion of padi land left unplanted.

In the Panchang Bedina area in Sabak Bernam sub-District where controlled drainage is being provided, some 5,500 acres of new padi land were planted. Rats did extensive damage to 900 acres but the crop from the remaining 4,600 acres is expected to average 300 gantangs per acre.

In parts of Johore the work of preparing the land for planting was delayed by floods.

Coconuts and Copra.—The average price of copra declined a little further in most localities, ranging from $1 to $2.75 per picul, although a price of $3.50 is recorded from one locality in Kedah. The Singapore price was about $2.30 per picul.

In spite of the very low price, some further progress can be recorded in the preparation of improved copra. Four approved kilns have been completed and are now working in various parts of the Settlement of Penang. With the aid of Government, a kiln has been completed in the Muar District of Johore and a scheme for other Government-aided kilns to be run under the supervision of small local committees is under consideration. A mud-walled kiln at Kuala Pahang is being replaced by a brick kiln. Small-holders appear to be commencing to realise that, in the face of prevailing conditions, it is becoming increasingly necessary for them to prepare copra of good quality if their product is to remain saleable. In this connexion it may be mentioned that work is reported to have stopped on several primitive kilns in Selangor, though the improved kilns continue in use.

Pineapples.—As was anticipated, the supply of fruits increased considerably during the month and the canning factories were kept busy. Prices for fresh fruit in Johore were:—first quality $2, second quality $1.30 and third quality $0.80 per hundred. Corresponding prices in Singapore were $2.60 and $1.40 per hundred.

In the Pontian and Kukub areas of Johore, all available land is being planted up with suckers. The first crop of fruit from the Mandai area in Singapore was being harvested.

A meeting of the representatives of the Pineapple Industry with the Director of Agriculture in Singapore on April 17th. resulted in considerable progress towards the adoption of a grading scheme and the establishment of grading standards for canned pineapples.

Fruit.—In Malacca, mangoes and chikus made their appearance in the markets. Light crops of mangoes, oranges and jambu were obtained in western Pahang and good crops of mangoes and jambu in Johore.

During the month, a further consignment of fresh limes was exported to England from Singapore, the fruit being specially sorted and packed.

Tobacco.—Prices of sun-dried leaves have ranged from $7 to $36 per picul according to quality in most parts of the country, thus showing little change; they remained high at $15 to $60 per picul in Johore. In Malacca a further rise, giving a range of $25 to $40 per picul, has aroused renewed interest in this crop. In Kedah, planting has been commenced with the advent of rainy weather and in the Baling District some 52 acres have been planted.

Cigar leaf, cured about two years ago at the Pineapple Experiment Station in Singapore for a private grower, was kept to mature and sold in April. It had changed considerably in colour, texture and aroma and appeared to be excellent leaf. Reports on its quality were favourable and it sold for $65 per picul.

Agricultural Stations.

Work on the planting programmes for annual and permanent crops and other routine operations were continued under favourable conditions throughout the month.

The establishment of the Agricultural Station in Labuan has been commenced and good progress has been made in the development of the Kilanas Station in Brunei.

At Selama Station slime diseases destroyed most of the young tobacco and and at the Pineapple Station in Singapore the tobacco crop was severely damaged by stem borers.

At the Tanah Rata Station, Cameron Highlands, a big crop of tea leaf was obtained. The second consignment consisting of 68 half chests containing 4,368 lbs. of tea from this Station was sold in London during the month at an average price of 1/1.75 per lb. This compares with 1/1.35 per lb. received for the first consignment which comprised 111 half chests containing 6,976 lbs. sold in London in November, 1933.

The etiolated shoot method of propagation has so far given rooted shoots of limes, Mandarin oranges and rambutans at the Bukit Mertajam and Selama Stations.

Padi Stations and Test Plots.

A new Caterpillar tractor was received and successfully used for stumping and ploughing on the additional 30 acres of land for experiments in the mechanical cultivation of rice at the Pulau Gadong Station in Malacca.

Nurseries were sown and the land was prepared for planting at six Test Plots in Selangor, Negri Sembilan and Pahang.

The inter-season crop of vegetables at Bukit Merah Station made satisfactory progress, but at the Kendong Test Plot vegetable trials gave little promise of success.

Two new beds of mushrooms at Bukit Merah Station in Province Wellesley fruited as also did another prepared for the Show at Balik Pulau in Penang.

Rural Lecture Caravan.

The Caravan toured Malacca from April the 4th. to 26th. Poultry husbandry and the preparation of improved copra formed the subjects of lectures and demonstrations.

Holiday Course.

A holiday course for boys from the Bukit Mertajam High School was commenced at the Bukit Mertajam Agricultural Station on April 24th. This course which was conducted by the Agricultural Field Officer, Province Wellesley and Penang, lasted eleven days and was attended by 14 boys. Work was confined to the mornings and attendance was purely voluntary. The early part of the morning was allotted to practical work and this was followed by a lecture. The subjects dealt with comprised planting operations, propagation by seed and by vegetative methods, rotation of crops and practical methods of control of pests and diseases of crops. An officer of the Rubber Research Institute of Malaya gave a most useful demonstration of budding rubber in connexion with vegetative methods of propagation. After a lecture on rat destruction, the boys took part in a rat hunt. They were also shown mushroom cultivation and given a demonstration of the construction and use of a copra kiln of approved pattern. The course is considered to have been a success to which the assistance rendered by the Head Master of the Bukit Mertajam High School did much to contribute.

Agricultural Shows and Malayan Padi Competition.

A successful Show organised by the District Economic Board under the Chairmanship of the District Officer, Province Wellesley, was held at Bukit Mertajam on April 20th. and 21st. in the hall of the High School. The first stage of the Malayan Padi Competition was conducted at this Show at which the winning exhibits for despatch to the Kuala Lumpur Show were selected.

The Department of Agriculture staged an exhibit which comprised:— samples of padi illustrating the qualities required for the Malayan Padi Competition, mushroom cultivation, and rat destruction. The Health Department also provided a series of exhibits devoted to rural hygiene.

This was the first Show held in the Province. The quality of the exhibits was good and much local interest was aroused.

A short account of the Agricultural Show at Balik Pulau Penang, will be found elsewhere in this number.

Local competitions in connexion with the Malayan Padi Competition were held in many parts of the country.

DEPARTMENTAL NOTES.

Presentation of Prizes, School of Agriculture.

The distribution of prizes and diplomas to students on the completion of their three years' course of training took place at the School of Agriculture, Malaya, on 19th. April, 1934, the awards being kindly distributed by The Hon'ble Mr. T. S. Adams, British Resident, Selangor.

The Principal of the School, The Hon'ble Dr. H. A. Tempany, C.B.E., in his opening speech welcomed the British Resident and made reference to the Resident's keen interest in and sympathy with, all attempts to broaden and stabilise the basis of Malayan agriculture.

He outlined the history of the School and recalled the difficult times through which the School had successfully passed. In conclusion he paid a tribute to the efforts of the Staff and the keenness of the students.

Mr. G. E. Mann, M.C., Vice-Principal, reviewed the school activities for the past year. He remarked that the change over in the curriculum from a three year to a two year basis for the major course appeared to be justifying itself and pointed out that it had been possible to extend the practical side of the curriculum.

After referring to the keenness and efficiency of the Malayan Volunteer Infantry platoon under the command of Mr. Dawson, he alluded to the activities of the School on the playing field.

The British Resident then distributed the prizes, after which he addressed the students, reminding them of the important part many of them were destined to take in bridging the gap between the research scientist and the raiat. The Asiatic field staff would not find their duties light; it would call not only for technical knowledge, but ability to convert such knowledge into simple language, to back it up by demonstration, and to present it with sympathy and tact. In conclusion, he complimented the School on its successes. His final good wishes to the departing students carried with them the advice not to regard the end of their school life as the end of their education, but rather as the beginning of a somewhat wider type of education.

Tour of the Director of Agriculture.

The Director of Agriculture paid an official visit to Malacca and Singapore between April 13th. and April 18th. On April 14th. he inspected the Stations at Pulau Gadong and Sungei Udang, addressed the Annual General Meeting of the Malacca Planters' Association, conferred with The Hon'ble Resident Councillor and the Agricultural Field Officer. In the evening he attended a demonstration by the Rural Lecture Caravan which was touring the Settlement at the time.

On April 15th. he proceeded to Singapore via Johore, conferring with the Agricultural Officers *en route*.

On April 16th. he conferred with the Agricultural Field Officer, Singapore and with others concerning various questions, and in the afternoon he attended a Conference with the Registrar-General of Statistics.

On April 17th. he visited the Singapore Dairy Farm and the Mandai district. In the afternoon he attended a conference of pineapple packers and exporters at the Singapore Chamber of Commerce, relative to the introduction of grading in the pineapple industry.

He returned to Kuala Lumpur on the 19th. April.

Tours.

Mr. F. C. Cooke, Officer-in-Charge, Copra Investigations, visited the West Coast of Johore, at the invitation of the Johore Government, between 10th. and 15th. April, for the purpose of discussing with officers concerned, proposals for the development of copra manufacture by small-holders and to inspect demonstration kilns under construction.

Transfers.

Mr. W. G. Higgins, Assistant to Statistician, has been transferred temporarily, to the Field Branch, from April 26th., 1934, on which date he proceeded to Kuala Kangsar to act as Agricultural Field Officer, Perak Central.

Mr. J. A. Craig, Principal Agricultural Officer, Kelantan, has been transferred to the School of Agriculture, Malaya, to act as Vice-Principal of the School during the absence on leave of Mr. G. E. Mann.

Mr. N. H. Sands, Acting Agricultural Field Officer, Perak Central, has been transferred to Kelantan, where he will act as Principal Agricultural Officer, during the absence from the State of Mr. J. A. Craig.

Leave.

Mr. G. E. Mann, M.C., Vice-Principal, School of Agriculture, Malaya, has been granted 9 months and 24 days leave on full pay from 27th. April, 1934, to 19th. February, 1935, inclusive.

Mr. R. G. H. Wilshaw, Agricultural Field Officer, returned from leave on April 24th., 1934.

Statistical

MARKET PRICES

April 1934.

Rubber.—The market price of rubber steadily increased during the month, opening at 17⅜ cents per lb. for spot loose in Singapore and closing at 21½ cents per lb. The higher price was caused by the expectation of the early introduction of a measure of restriction of production or exports. The average price for the month in Singapore was 18.75 cents per lb., as compared with 17.18 cents per lb. in March. The average price in April in London was 5.65d. per lb., and 11.94 cents gold per lb. in New York, as compared with 5.18d. in London and 10.87 cents gold in New York in March.

Weekly prices during April for small-holders' rubber at Kuala Pilah, Negri Sembilan; Kuala Kangsar, Perak and Batu Pahat, Johore, were as shewn in Table II.

Palm Oil.—The course of the market is shewn in the following table. Basis 5 per cent. f.f.a.

Table I.

DATE	PALM OIL			KERNELS
	L'Pool/Holland/ Hamburg c. i. f. landed weights in bulk per ton £. s. d.	U.S.A. landed weight per lb. c. i. f. New York/ Philadelphia cents gold	L'Pool/Continent c. i. f. per ton net in barrels £. s. d.	Fair Average Malayan Quality c. i. f. Landed Weight per ton on Continent. £. s. d.
April 4	12 15 0	2.45	10 10 0	6 2 6
,, 11	13 10 0	2.45	11 0 0	6 5 0
,, 18	12 15 0	2.30	10 10 0	6 5 0
,, 25	12 15 0	2.30	10 10 0	6 5 0

Copra.—The price of Sundried copra in Singapore remained steady during April, between \$2.55 and \$2.65 per picul, the average price for this grade being \$2.62 per picul as compared with \$2.90 per picul in March. The mixed quality averaged \$2.15 per picul as compared with \$2.31 in March.

Copra cake was quoted throughout the month at \$1 per picul.

Rice.—The average wholesale price of Siam No. 2 ordinary rice per picul in Singapore in March was \$2.82 as compared with \$3.06 per picul in February. No. 1 Rangoon rice averaged \$2.47 per picul in March as compared with \$2.50

Table II.

Grades	VALUE PER PICUL (dollars)														
	Kuala Pilah, Negri Sembilan.							Kuala Kangsar, Perak.				Batu Pahat Johore.			
	8.3.34	22.3.34	29.3.34	5.4.34	12.4.34	19.4.34	26.4.34	4.4.34	11.4.34	18.4.34	25.4.34	4.4.34	11.4.34	18.4.34	25.4.34
Smoked sheet	20.44	20.30	21.40	22.06	22.17		24.39					21.50	21.27	22.66	23.26
Unsmoked sheet	17.66	19.39	18.67	19.48	15.33	20.77	21.55					†18.00			
Rubber*								2.180	20.57	20.53	22.73		6.80	7.06	
Scrap	6.88	†5.30	6.00	8.96	8.15	8.00	11.84								

† Very small purchase.

* Wet unsmoked sheet.

Transport by lorry Kuala Pilah to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent.

per picul in February and Saigon No. 1 (long grain) $2.62 in March as compared with $2.60 in February. Corresponding prices in March 1933 were $3.40, $3.05 and $3.32 respectively.

The average retail market prices in cents per gantang of No. 2 Siam rice in March were:—Singapore 23, Penang 26, Malacca 24, as compared with 22, 26, 24 respectively in February and 23, 28, 24 in January.

The average declared trade value of imports of rice in March was $3.11 per picul, as compared with $3.20 per picul in February and $3.30 per picul in January 1934.

Tea.—During March, the London price quoted for Malayan tea was 1s.1d. per lb. Average London prices per lb. during March for tea consignments from other countries were as follows:—Ceylon 1s.3.08d.; Java 1s.0.41d.; Indian Northern 1s.2.14d.; Indian Southern 1s.2.29d.; Sumatra 11.83d.

The London market has been weaker, and although the demand has been good, prices shewed a downward tendency throughout the month.

Tuba Root.—There is a considerable difference between sellers' ideas of prices and those of buyers. In consequence, little fresh business has been transacted. Sold on rotenone-content basis prices have averaged $32.50 per picul, while roots sold on ether extract basis averaged $26 per picul during April.

Coffee.—The Singapore price of coffee shewed a slight upward trend during April: the average price for the month was $20.69 per picul. Palembang coffee rose from $15.25 to $15.75, the average price being $15.62 as compared with $16.20 in March.

Arecanuts.—Supplies of the various grades, with the exception of Bila Whole, are now available. Average prices per picul in Singapore during April were: Splits $2.65 to $4.27; Sliced $7 to $10.95; Red Whole $2.75 to $3.85; Sourabaya Whole, $4.34 to $5.75; Kelantan $3.50 to $3.96, the prices within these ranges depending upon quality.

Gambier.—Block gambier declined 25 cents per picul to $3.75 per picul, the average price for the month being $3.81 as compared with $4.19 in March. Cube No. 1 remained firm at $6.75 as compared with an average price of $6.69 per picul in March.

Pineapples.—Values hardened somewhat towards the end of the month. The London market will not pay the prices demanded by sellers in Singapore. Average Singapore prices per case in April were:—Cubes $3.04, Sliced Flat $2.93, Sliced Tall $3.02, as compared with $3.12, $2.98 and $3.06 respectively in March.

Tapioca.—The Singapore market was dull during the first half of the month, but in the latter part of the month prices were steady at the recent low levels, with more enquiry at the end of the month. Average prices per picul in April were:—Flake Fair $4.19, Pearl Seed $5.39, Pearl Medium $6, as compared with $4.70, $5.80 and $6.38 in March.

Sago.—The trend of the Singapore market was similar to that for tapioca. Average prices per picul in April were:—Pearl—Small Fair $3.74, Flour, Sarawak Fair $1.81 as compared with $3.76 and $1.87 respectively in the previous month.

Mace.—In the latter half of the month, Singapore prices firmed; nominal prices are higher, but sellers will reduce for firm business. Average prices per picul in April were:—Siouw $67.50, Amboina $45, as compared with $65 and $40 respectively in March.

Nutmegs.—The Singapore price for 110's was steady during April at $22.50 per picul, while 80's declined to $23 per picul; the average prices per picul being $23.50. Corresponding average prices in March were $24.25 and $26.75.

Pepper.—Prices in Europe tend to harden, in consequence of which prices improved in Singapore towards the end of the month. Average Singapore prices per picul in April were:—Singapore Black $15.25; Singapore White $29.62; Muntok White $30.12 as compared with $15.69, $29.88 and $30.75 in March.

Cloves.—Prices continued steady and nominal at $35 per picul for Zanzibar $45 per picul for Amboina.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Mackay & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY. *

March, 1934

Malaya.—The imports of foreign rice into Malaya during March were 52,693 tons and exports during the month 10,332 tons. The net imports for the first quarter 1934 were 109,263 tons as compared with 98,448 tons in the corresponding period of 1933, an increase of 11 per cent.

Of the imports during March, 53 per cent. were consigned to Singapore, 15 per cent. to Penang, 4 per cent. to Malacca, 19 per cent. to the Federated Malay States and 9 per cent. to the Unfederated Malay States. Of the total 68 per cent. came from Siam, 28 per cent. from Burma, 3 per cent. from French Indo-China and 1 per cent. from other countries. Of the exports during March 70 per cent. were shipped to Netherlands India and 30 per cent. to other countries.

The various kinds of rice exported were :—Siam 6,358 tons (62 per cent.), Burma 3,335 tons (32 per cent.), Indo-China 263 tons (3 per cent.), Local production 345 tons (3 per cent.) and India 31 tons.

India and Burma.—Foreign exports in February were 122,000 tons as compared with 77,000 tons in January, and with 68,000 tons in January 1933 and 174,000 tons in February 1933.

The total exports of rice and bran from Burma for the period 1 January to 3 March 1934 amounted to 528,728 metric tons as compared with 505,828 metric tons for the corresponding period of 1933, an increase of 4.5 per cent.

Japan.—Latest information available published in the Summary for February 1934.

Siam.—The third and final forecast received from the Department of Commerce, Ministry of Economic Affairs, Bangkok, dated 3rd. April 1934 states that the area planted as at the end of January amounted to 8,100,000 acres, an increase of 100,000 acres as compared with the previous estimate. The area damaged was approximately 600,000 acres. The total outturn was estimated at 3,054,925 tons (rice) and the surplus available for export at 1,440,325 tons (rice).

French Indo-China.—Entries of padi into Cholon January to March amounted to 326,000 tons, this being the same figure as for the corresponding period of 1933. Exports of rice January to March 1934 were 341,000 tons as compared with 362,000 tons for the corresponding period of 1933, a decrease in 1934 of 5.8 per cent.

A report on the Saigon Rice Market for March 1934 states that the market for padi was active in March with a continued decline in prices. Arrivals from the interior have been normal for the time of the year.

Rice prices fell gradually, and during the second half of the month, France remained the only important buyer. From $3 (Saigon) on 1st. March, the price of No. 1 rice fell to $2.86 (Saigon) per 100 kilogrammes at the end of the month. Brokens :—Market firm as a result of poor stocks.

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* Abridged from the Rice Summary for March 1934, compiled by the Department of Statistics, S.S. and F.M.S.

Netherlands India.—Imports of rice in January were 10,822 metric tons, as compared with 35,890 metric tons in January 1933, a decrease of 69.8 per cent. Of these imports 8,804 metric tons were into the Outer Provinces and 2,018 metric tons into Java and Madura.

Ceylon.—Imports for January and February 1934 were 82,674 tons as compared with 71,252 tons during the corresponding period of 1933, an increase of 16 per cent. Of these imports, 15 per cent. were from British India, 70 per cent. from Burma and 15 per cent. from other countries.

Europe and America.—Quantities of rice shipped from the East were:—

(*a*) To Europe: for the period 1st. January to 22nd. March, 170,277 tons as compared with 280,966 tons for the corresponding period of 1933, a decrease of 39 per cent. Of these shipments 26 per cent. were from Burma, nil from Japan, 53 per cent. from Saigon, 61 per cent. from Siam and 5 per cent. from Bengal as compared with the following percentages 39, 8, 44, 8 and 1 respectively in 1933.

(*b*) To The Levant: 1st. January to 28th. February, 1934, 5,327 tons as compared with 4,560 tons for the same period in 1933, an increase of 16.8 per cent.

(*c*) To The West India and America: 1st. January to 28th. February, 11,852 tons as compared with 17,218 tons during the corresponding period of 1933, a decrease of 31.2 per cent.

MALAYAN AGRICULTURAL EXPORTS, MARCH, 1934.

PRODUCT.	Net Export in Tons.				
	Year 1933.	Jan.-Mar. 1933.	Jan.-Mar. 1934.	March 1933.	March 1934.
Arecanuts ...	20,756	5,506	9,749	973	2,035
Coconuts, fresh ...	100,609†	21,609†	21,652†	5,455†	7,108†
Coconut oil ...	17,568	4,636	6,251	1,676	2,384
Copra ...	110,543	20,902	27,499	1,911	10,445
Gambier, all kinds ...	2,560	593	559	199	231
Palm kernels ...	1,983	353	497	154	151
Palm oil ...	12,101	1,102	2,244	540	580
Pineapples canned ...	59,582	12,935	14,289	3,910	5,457
Rubber ...	459,836§	99,304§	124,161§	31,917§	40,751§
Sago,—flour ...	7,648	1,481	3,469	112	2,381
„ —pearl ...	2,646	505	766	157	291
„ —raw ...	4,420*	1,078*	1,080*	361*	312*
Tapioca,—flake ...	9,881	3,055	2,172	1,141	993
„ —flour ...	702*	36	532*	328*	319*
„ —pearl ...	17,297	3,465	3,775	1,047	1,442
Tuba root ...	569½	80	150½	37	44

† hundreds in number. * net imports. § production.

MALAYAN PRODUCTION IN TONS OF PALM OIL AND KERNELS 1st. QUARTER, 1934.

(As declared by Estates).

	Palm Oil		Palm Kernels	
	F.M.S.	Johore.	F.M.S.	Johore.
1934 January ...	926.0	166.3	152.9	30.8
February ...	849.7	129.9	131.6	27.3
March ...	1046.1	220.6	183.0	42.7
TOTAL ...	2821.8	516.8	467.5	100.8

MALAYA RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING MARCH, 1934.

State or Territory	Acreage of Tappable Rubber end 1932 (d)	Estates which have entirely ceased tapping		Estates which have partly ceased tapping		Area of Tappable Rubber never been tapped		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
STRAITS SETTLEMENTS :—									
Province Wellesley	44,734	1,323	2.9	7,430	16.6	1,054	2.4	8,753	19.6
Dindings	6,969	209	3.0	849	12.1	536	7.7	1,058	15.2
Malacca	111,780	4,619	4.1	15,232	13.6	5,582	5.0	19,851	17.7
Penang Island	1,635	623	38.1	176	10.7	177	10.8	799	48.9
Singapore Island	28,269	5,346	18.9	4,764	16.8	566	2.0	10,110	35.8
Total S.S. ...	193,387	12,120	6.2	28,451	14.7	7,915	4.1	40,571	21.0
FEDERATED MALAY STATES :—									
Perak	250,951	3,786	1.5	27,987	11.1	14,426	5.8	31,773	12.7
Selangor	308,379	1,106	0.4	36,424	11.8	13,441	4.3	37,530	12.2
Negri Sembilan	228,541	5,125	2.2	22,061	9.6	16,407	7.2	27,186	11.9
Pahang	38,141	4,819	12.6	3,677	9.6	6,396	16.8	8,496	22.3
Total F.M.S. ...	826,012	14,836	1.8	90,149	10.9	50,670	6.1	104,985	12.7
UNFEDERATED MALAY STATES :—									
Johore	325,747	15,549	4.8	31,882	9.8	21,293	6.5	47,431	14.5
Kedah (a) (b)	126,588	3,595	2.8	9,556	7.6	(e) 5,700	4.5	13,151	10.4
Kelantan	21,176	2,080	9.8	2,294	10.8	3,591	16.9	4,374	20.6
Trengganu (c)	4,643	Nil	Nil	1,609	34.6	200	4.3	1,609	34.7
Perlis (a) (b)	957	106	11.1	131	13.7	308	32.2	237	24.7
Total U.M.S. ...	479,111	21,330	4.4	45,472	9.5	31,092	6.5	66,802	13.9
TOTAL MALAYA ...	1,498,510	48,286	3.2	164,072	10.9	89,677	6.0	212,358	14.2

Notes :—(*a*) Registered companies only and are rendered quarterly.

(*b*) The figures quoted for Kedah and Perlis are those for end December 1933, and Kelantan end January, 1934 Revised figures will be published when available.

(*c*) Registered Companies only.

(*d*) Figures for end December 1933, are not yet available.

(*e*) Estimated: figures not yet available.

MALAYA RUBBER STATISTICS　　TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF MARCH, 1934 IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month		
								during the month		January to Mar. inclusive 1934		during the month		January to Mar. inclusive 1934				
	Ports	Dealers	Estates of 100 acres and over	during the month	January to March inclusive 1934	during the month	January to March inclusive 1934	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States ...	...	15,490	11,345	11,231	34,735	11,551	32,492	Nil	Nil	Nil	Nil	16,530	6,916	48,361	18,105	...	16,339	9,813
Johore ...	...	3,935	3,294	3,492	10,765	4,178	13,909	Nil	3	Nil	13	1,565	6,879	4,774	19,942	...	3,404	3,054
Kedah ...	...	384	2,352	2,518	8,410	1,447	5,046	Nil	Nil	Nil	Nil	1,660	2,896	4,559	9,584	...	323	1,822
Perlis ...	...	22	15	14	43	41	109	Nil	Nil	Nil	Nil	Nil	64	Nil	167	...	14	14
Kelantan ...	...	382	261	181	665	1,236	2,722	Nil	Nil	319	Nil	114	1,269	260	3,187	...	553	124
Trengganu ...	...	55	50	221	619	111	308	Nil	Nil	Nil	Nil	Nil	332	Nil	927		55	50
Total Malay States	...	20,268	17,317	17,657	55,237	18,564	54,586	Nil	3	319	13	19,869	18,356	57,954	51,912	...	20,688	14,877
STRAITS SETTLEMENTS :-																		
Malacca ...	...	3,427	1,182	1,312	4,010			1		2		3,170		10,69[illegible]		...	3,812	992
Province Wellesley	...	926	543	477	1,632			Nil		Nil						...	1,871	435
Dindings ...	...	58	152	107	326	2,451	7,823	Nil	16,375	Nil	49,655	8,308	Nil	25,354	Nil	...	74	133
Penang ...	3,116	5,877	9	8	37			2,412		6,089						1,090	6,928	6
Singapore ...	4,961	34,215	159	175	510			17,494		44,652		27,168		77,437		6,841	38,608	144
Total Straits Settlements	8,077	44,503	2,045	2,079	6,515	2,451	7,823	19,907	16,375	50,743	49,655	38,646	Nil	113,483	Nil	7,931	51,293	1,710
TOTAL MALAYA	8,077	64,771	19,362	19,736	61,752	21,015	62,409	19,907	16,378	51,062	49,668	58,515	18,356	171,437	51,912	7,931	71,981	16,587

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
20	21	22	23	24	25	26
DRY RUBBER	12,207	31,838	5,955	4,587	1,569	100
WET RUBBER	4,132	6,770	973	1,170	1,835	223
TOTAL ...	16,339	38,608	6,928	5,757	3,404	323

TABLE III
FOREIGN EXPORTS

PORTS	For month	January to March 1934
Singapore ...	37,918	109,537
Penang ...	13,535	40,291
Port Swettenham.	6,215	19,245
Malacca ...	847	2,364
MALAYA ...	58,515	171,437

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January to March 1934
Malay States ... Straits Settlements	41,048	123,444
MALAYA ...	41,048	123,444

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] —[2]—[3]—[4]—[5]—[9]—[10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15 % to terms of dry rubber.

3. Foreign imports as published in Return I. & E. 5, wet imports being reduced to dry weight by 25% except those from Netherlands India which are reduced by the official percentages shown in Schedule I.

4. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15;% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

5. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 25th April.

METEOROLOGICAL SUMMARY, MALAYA, MARCH, 1934.

Locality	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total		Most in a day Amt.	Number of days: Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total	Daily Mean	Per cent
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.								
Railway Hill, Kuala Lumpur, Selangor ...	90.6	71.3	80.9	95	68	84	74	83.4	84.1	13.98	355.1	4.25	25	22	7	5		157.00	5.06	42
Bukit Jeram, Selangor ...	87.4	71.8	79.6	91	69	84	75	83.5	85.0	10.34	262.6	1.40	23	19	5			184.55	5.95	49
Sitiawan, Perak ...	88.5	72.4	80.5	93	70	85	75	83.1	83.8	14.13	358.9	2.82	16	13	3	1		193.80	6.25	52
Temerloh, Pahang ...	87.2	71.9	79.5	93	69	79	75	83.0	84.0	7.89	200.4	1.82	19	18		1		156.95	5.06	42
Kuala Lipis, Pahang ...	86.7	71.4	79.1	92	69	78	74	82.5	82.7	7.13	181.1	2.12	20	16	1	15		138.85	4.48	37
Kuala Pahang, Pahang ...	83.9	73.8	78.9	89	71	78	78	82.4	82.5	11.04	280.4	2.56	18	14	1		1	189.15	6.10	50
Mount Faber, Singapore ...	85.5	71.8	78.7	90	69	73	75	79.4	80.1	10.65	270.5	4.38	22	15	3	1	2	159.70	5.15	43
Butterworth, Province Wellesley ...	88.0	72.6	80.3	91	70	84	75	83.7	84.5	7.62	193.6	2.00	15	14	4			208.95	6.74	56
Bukit China, Malacca ...	84.6	72.8	78.7	89	69	76	76	81.2	82.0	11.74	298.2	5.85	18	13	1		2	156.25	5.04	42
Kluang, Johore ...	86.2	71.2	78.7	92	68	75	74	80.1	80.2	15.62	396.8	7.31	21	16		4		155.35	5.01	41
Bukit Lalang, Mersing, Johore	83.5	72.4	77.9	90	70	79	75	79.9	79.5	9.21	233.9	1.25	17	15	1	2	2	187.80	6.06	50
Alor Star, Kedah ...	90.8	71.5	81.1	93	69	87	73	84.0	84.0	2.95	74.9	1.20	16	10	13	3		228.65	7.38	61
Kota Bahru, Kelantan ...	86.4	72.7	79.5	91	70	80	77	81.9	82.4	3.07	78.0	0.86	13	10				199.30	6.43	52
Kuala Trengganu, Trengganu	85.0	72.5	78.7	89	69	79	76	81.2	81.7	3.87	98.3	1.33	13	11		3	1	197.40	6.37	53
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. Pahang ...	71.6	61.6	66.6	79	60	63	64	69.9	70.1	12.80	325.1	2.88	22	19	1	14	1	105.65	3.41	28
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	71.2	56.2	63.7	76	51	65	61	68.1	68.2	13.27	337.1	2.05	20	20	1	1	1	103.25	3.33	27
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	70.2	58.8	64.5	75	57	65	61			13.78	350.00	2.45	25	22		1	1	114.60	3.70	30

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THE

Malayan Agricultural Journal.

JUNE, 1934.

EDITORIAL.

Marketing Fruit.

The organisation of the marketing of fruit in Malaya has long been recognised as a problem of considerable difficulty, by reason of the fact that there are few economic areas under one variety, fruit trees of numerous varieties are very scattered and many areas are not readily accessible to market centres. For these reasons, and also on account of the necessity for good marketing and transport facilities, fruit cultivation is apt to languish and be restricted to the provision of supplies for sale in the immediate neighbourhood in which they are grown.

While the above is generally true of Malayan conditions, it is not forgotten that there are exceptions; notably, the marketing of fresh pineapples from the extensive areas in Johore and to a less extent in Selangor; bananas from certain areas in Negri Sembilan and elsewhere and duku and other fruits from the old-established orchards in Malacca.

The organisation of fruit marketing demands a precise knowledge of the extent of the planted areas and the kinds of fruits grown thereon throughout the producing districts and an efficient system of marketing intelligence. Given this organisation, it may become possible to arrange distribution of fresh fruits to markets in which there is a shortage of supplies—although such shortage may be of but a temporary nature.

Furthermore, the marketing locally of fresh fruits in good condition necessitates adequate and rapid transport facilities. This fact handicaps the marketing of fruit from the less accessible areas, on account of time taken in bringing the produce to market and expense of transport.

The present organisation of the Department of Agriculture precludes any extensive work being undertaken on the organisation of the marketing of fruits. As a preliminary, however, a survey is being undertaken regarding the kinds of fruits grown in different areas, the amount of surplus fruit available from time to time and the present marketing methods. A survey of the areas in Malacca was undertaken some time ago and the result published in this journal in February 1933. In the present number will be found a record of a somewhat similar survey of the areas in Pahang. It is hoped that the survey may

be extended to other States in which fruit is at all widely grown. These records will serve as a basis for consideration of organising greater facilities for marketing fruits in the most favourable markets.

Attention is also drawn to an account in this number of an enquiry into the marketing of fresh bananas in the United Kingdom and Australia. It is concluded that on account of distance from the market, transport difficulties and the existance of sources of supplies more favourably situated, there is at present no likelihood of markets developing for Malayan bananas in these centres.

Field Experiments.

Included in the present number is an article setting forth the standard methods used in laying out field experiments. This Department frequently cooperates with estates in the conduct of experiments. Such experiments are normally devised and supervised by a scientific officer, but the actual conduct of the work and the harvesting of the crops is frequently in the hands of the owner or manager of the property. The success of the work depends on the amount of care and supervision which the man on the spot can give, and we take this opportunity of recording our grateful thanks to the numerous practical men who have assisted us in this respect from time to time.

In order that field experiments may be critically examined, it is essential that the standard methods be closely followed. Much experimental work by non-technical men—and let it be acknowledged, by technical bodies too—has proved useless because the investigator has not taken precautions to obviate variations in results due to factors other than those under investigation.

It is thought that the account here given will be acceptable to those who kindly assist us in our investigations and may be of use to others who desire to undertake independant investigations with field crops.

Diseases of Tobacco.

Included in this number is an article which summarises our present knowledge of diseases of tobacco in Malaya. On account of the increasing area under cultivation with this crop in Malaya, diseases assume greater significance. By the nature of these diseases, especially of slime disease, it is most important that the grower should take precautions against their spread; neglect in this respect may seriously prejudice the industry in the future. Adequate control necessitates early recognition of the symptoms, and for this reason, the notes on this subject, which we here publish, are commended for the close attention of cultivators.

In passing, readers are reminded that an article dealing with the insect pests of tobacco in Malaya was published in this Journal in February, 1933.

Original Articles.

DISEASES OF TOBACCO IN MALAYA

BY

A. THOMPSON,

Government Mycologist.

Introduction.

The tobacco plant is subject to many diseases caused by the attack of parasitic fungi and bacteria, and there is considerable information available from tobacco-growing countries relating to these maladies. In Malaya, where interest in the cultivation of this crop is of recent date, information regarding local diseases is as yet scanty.

Two of the most prevalent diseases are slime disease and leaf spot. In addition to these diseases which are caused by micro-organisms, some diseases of obscure nature have been recorded from time to time. In these cases, the trouble may take the form of malformations of the leaves, chlorosis (yellowing) or mottling, and while, in some instances, it is probable that a disease of the nature of a virus disease, such as ordinary "mosaic" disease, is responsible, in other cases it is probable that the abnormalities are due to deficiency in an element or elements of plant food, or to environmental conditions.

Slime Disease.

This disease is the most serious disease of tobacco plants in Malaya.

Symptoms.—Some of the leaves on a plant infected with slime disease begin to wilt and during the hotter part of the day will hang limply down the stem. During the night these leaves may recover their turgidity to a certain extent, but on the following day they will again wilt and every day a larger number of leaves will show similar symptoms until in about one week all the leaves and the top of the stem are wilted and the plant finally dies.

The stems of affected plants may not exhibit any abnormal symptom in the early stages of the disease, but as the disease progresses, a brown and finally a black discolouration becomes evident in the tissue of the stem.

The roots of diseased plants may not appear to be diseased, but when the disease becomes evident in the leaves some of the roots may be discoloured brownish-black and the tips may be decayed.

If the stem of a diseased plant is cut across close to the ground, there is usually a brownish ring present just beneath the epidermis, in the vascular system. In very early stages of the disease, this brown ring may not be developed, but when several leaves have wilted it is normally present. On squeezing the cut stem, a dirty-white slime exudes from this ring, especially in fairly advanced cases.

This slimy fluid contains millions of bacteria which plug the food-conducting vessels in the stem and roots, thus interfering with the circulation of the sap. The bacteria also produce a toxic substance and this, combined with the plugging of the vessels, causes the plants to wilt.

The organism.—The organism, which lives in the soil, is a short-rod bacterium—*B. solanacearum* E.F.S; it has been recorded as a parasite of many species of plants. In addition to attacking tobacco, the organism is the main cause of the well-known wilt of tomato plants in this country, while it is also known to attack groundnut, brinjal, arrowroot, chilli, petunia, and potato and possibly can attack many of the local species of *Solanaceae*.

The Disease in the Nurseries and in the Field.—The bacterium enters a plant by means of the roots, probably through small wounds, and multiplies rapidly in the vascular system, secreting substances that are poisonous to the plant. Plants may be attacked at any stage of growth, but very young seedlings are rarely affected. When the plants in a nursery bed are ready to transplant, some of them may show signs of infection, but frequently the disease does not appear until the plants have been transplanted into the field. Jochems (1) states that this seed-bed infection usually appears in the nurseries when the roots of the older seedlings have penetrated into the lower unsterilized layers of soil. In seedlings taken from infected nurseries, symptoms of the disease may appear within a few days after transplanting, whereas if healthy seedlings are planted in infected soil, 3 to 4 weeks may elapse before the first symptoms appear.

The disease can spread from infected plants to adjoining healthy plants which may not show the symptoms for some weeks. Consequently, although the initial mortality in a plot of young plants may be slight, a few weeks later many of the plants may become affected. In some plants of the Joyner variety grown locally, the disease appeared just before the plants were topped. A knife was used for topping and within a few days it was noticed that a black discolouration was extending down the cut stem and passing into the lower leaves of formerly healthy plants. It is probable that the knife became infected through cutting a diseased stem and thus transmitted the infection to healthy stems.

When an area is planted with tobacco for the first time, slime disease may not appear unless the land had been used recently for the cultivation of other susceptible host plants. If the tobacco crop shows no infection and if the land is cleared of the old plants when the crop is harvested, it is often possible to grow other crops of tobacco until the disease appears.

When the disease appears, the mortality may be as low as 10 per cent. in the first crop, but subsequent crops may be completely wiped out and the land cannot be used again for tobacco cultivation until it has been allowed to lie fallow for some years, and specially treated so as to suppress solanaceous weeds.

(1) Jochems Dr, S. J. Med. v.h. Deli Proefstn. 43. Ser. 2, 1926,

If susceptible host plants are not permitted to grow in infected soil, the bacterium loses virulence after a period of some years and a crop of tobacco can again be obtained.

In Netherlands India where there are large areas under tobacco cultivation and where slime disease has caused considerable damage, it is the practice to adopt a seven-or eight-year rotation, sometimes with rice and maize which are immune from the disease, or with *Mimosa invisa* which helps in suppressing susceptible species and is itself immune.

So far as is known, all varieties of tobacco can be attacked by slime disease. The varieties on which the disease has been recorded in Malaya are—Deli, Burmese, Joyner, Hickory Prior, White Burley, Russian, Bhengi, and Ceylon.

The problem of controlling soil-borne diseases is always difficult and expensive, when varieties resistant to the disease are not available. So far, no strains of tobacco fully resistant to slime disease have been discovered or produced by selection or breeding.

Slime disease is said to be more virulent on some types of soil than on others. According to Jochems, (*loc. cit*) crops growing in red laterite soil nearly always suffer badly from slime disease, but it is not yet clearly ascertained to what properties the enhanced liability of some soils to this disease is due.

Control Measures: *Prevention.*—It is very desirable that land which is free from slime disease should be protected, as far as possible, from becoming infected. Infection is certain if diseased seedlings are planted, and consequently one of the most important preventive measures is to sow the seed in nursery beds of sterilised soil, or in soil which is known to be free from the disease. Seedlings from infected nurseries should not be planted in the field.

One method of sterilising infected soil in nursery beds is by steam. Chemical disinfectants have so far been found of little use, not only on account of the cost and the difficulty of application, but also, in some cases, on account of inefficiency.

In order to steam-sterilise a seed-bed, a portable boiler and an inverted pan made of re-inforced galvanised iron can be used. The size of the pan varies according to requirements, a convenient size being 6 feet by 12 feet by 8 inches high. The pan is placed over the soil and pressed into it and steam is passed into the pan through a hose pipe at a pressure of about 80 lbs. per sq. in., by means of an inlet in the top of the pan, and the soil is steamed for about 30 minutes. The pan is then moved along the seed bed until all the soil has been steamed.

Steam sterilisation, however, is considered to be an impracticable method on the large nursery areas of the tobacco estates in Sumatra and it is out of the question for small-holders to adopt this method.

The practice of burning brushwood and grass on the surface of the soil of the seed bed is only partially successful, and better results would probably be obtained if the top soil could be removed, the lower layers surface fired, and the top soil fired when it is replaced on the bed. At present this appears

to be the only practicable method of soil sterilisation available for small-holders. In addition, the seed-bed should be raised so that contamination, by rain water flowing from adjoining and possibly infected soil, would be minimised.

On larger properties, the site of the nurseries should be changed frequently. After the seedlings have been removed, the soil should be fired and kept free from susceptible weeds by planting with a cover such as *Mimosa invisa* and allowed to lie fallow for as long a period as possible.

If seed-boxes are used for the growing of seedlings, the boxes should be discarded or else washed, inside and outside, with a disinfectant; *e.g.* 5 per cent. Izal, before they are used again.

Control in the Field.—Local experience with tobacco cultivation has shown that there is reason to expect that slime disease can cause as serious damage in Malaya as it has caused in Netherlands India, and in certain other countries. As mentioned above, the practice of rotation with rice and maize as well as *Mimosa invisa* over a period of seven to eight years is considered necessary in the large tobacco areas in Sumatra, and the possibility that a similar practice will be found necessary in Malaya should be borne in mind, if the establishment of any large areas devoted to tobacco cultivation is contemplated.

In the case of tobacco cultivation by small-holders, the problem is complicated by the small size of the holdings. Many small holdings are as yet free from the disease, but on holdings where it has occurred the mortality has been heavy.

When the disease makes its appearance, the infected plants should be dug out as soon as they are observed, removed to a safe place and burnt.

If diseased plants are not removed, the adjoining plants will almost certainly become affected, whereas there is a chance of saving healthy plants if diseased plants are quickly removed. It is also advisable if only a few plants are affected, to remove the soil beneath diseased plants and to discard it in a safe place, taking care to avoid scattering it in the planted area during removal. If possible, on small plots the soil should be fired; solanaceous crops should not be planted or permitted to grow in this soil for as long a period as possible.

Plants grown in badly-drained soil are more likely to become infected than those in well-drained soil. Consequently, it is important that the land should be adequately drained. Drainage alone will not eradicate the disease, but the number of casualties is frequently less on well-drained soil.

Finally, it is very important that all the old tobacco stalks should be removed from the land, and burnt, as soon as possible after harvest.

Leaf Spot.

Tobacco plants in Malaya are very frequently affected by a leaf disease caused by the fungus *Cercospora nicotianae* Ell and Ev.

The spots are at first small and round, brownish in colour and are first noticed on the older leaves. Later, some of the spots may coalesce and they gradually become white in the centre, concentrically zoned and finally dry up.

The disease is not regarded as serious in this country, since little damage is caused except when the leaves are intended for use as cigar or cheroot wrappers. In Rhodesia, however, the disease is said to lead to black spotting in the barns on flue-cured varieties.

Control.—Early removal and burning of the lower, infected leaves will keep the disease in check. Burgundy mixture sprayed on to the leaves of young plants is also beneficial.

Mosaic Disease.

Mosaic disease is an infectious disease which is readily transmissible to healthy plants from diseased plants. It belongs to the group of diseases known as virus diseases, and is due to the attack of a parasitic micro-organism.

The most characteristic symptom is a mottling of the leaves with irregular patches of light green and dark green, sometimes accompanied by blistering, curling, and distortion of the leaves.

The effect of the disease is to reduce the yield and quality of the leaf.

The disease is not seed borne, but it may appear in the nursery beds and, since it can be transmitted merely by touching a diseased plant and then touching a healthy plant, it may be spread to a number of plants during transplanting.

The disease is spread in the field mainly by handling when priming is first done, or when the plants are being examined for the presence of leaf-eating caterpillars.

Symptoms of the disease are not produced in the leaves already formed on a plant at the time the infection occurs, but appear in the leaves formed subsequent to infection, or in the suckers formed after topping. Nevertheless, the infection is present in all parts of the plant, except the seeds.

The infective principle can persist for years in dried tobacco leaves, and is not rendered inactive during the manufacturing process. Consequently, infection can be transmitted by workers using infected tobacco or snuff.

Fortunately, the disease does not infect the soil in which affected plants have been grown.

Control.—The symptoms of mosaic disease in infected seedlings are not very marked, and it is not always possible to ensure that all infected seedlings have been removed from the seed-bed before transplanting begins.

Prevention of seed-bed infection is, therefore, an important measure. This is best accomplished by locating the seed-beds at some distance from areas where tobacco is growing, by keeping down weeds in the seed-bed and in the neighbourhood of seed-beds, since some of these weeds may be susceptible to mosaic disease and it may spread to the tobacco seedlings. Muslin covers used on seed-beds should be boiled and dried before they are used again. All tobacco stumps and refuse should be removed from the land after harvest, so that infected plants will not be a danger to nearby seed-beds.

If the disease is found in the seed-bed, the infected plants and those in immediate contact with the infected plants should be carefully removed and burnt. The hands of the workers should be well washed and dried, immediately this is completed, and they should not handle the healthy seedlings when removing the infected plants. If there are numerous cases of mosaic infection in a seed-bed, it is advisable to destroy all the seedlings and obtain supplies from elsewhere.

In the field, infected plants should be removed quickly and carefully before the workers begin to handle the plants when looking for caterpillars.

General.

The diseases mentioned above are the only ones so far investigated on tobacco in Malaya. It is almost certain that others occur, but they have not yet been definitely recorded.

Among the diseases which may be expected to appear the following are the most important.

(*a*) Damping-off of seedlings caused by Fungi. *Rhizoctonia solani* causes a disease in which patches of seedlings die off and are attached to the soil by whitish-yellow mycelium which looks like a spider's web, and which can be seen in the early morning. *Phytophthora* sp. also kills very young seedlings in patches. In older seedlings the fungus may appear on isolated plants the stems of which turn jet-black, but do not exude slime when squeezed. These diseases can be controlled by spraying the seedlings periodically with weak Bordeaux (or Burgundy) mixture to which it is advisable to add 1 per cent. solution of lead arsenate to assist in controlling caterpillars. It is also important to prevent waterlogging of the soil, and to permit sunshine and air to have access to the plants.

(*b*) Stem Scorch.

Stem scorch caused by *Phythium* spp. is a disease which attacks the stems of the plants just below soil level, causes them to rot and the plants to fall over, or wither. The stem is markedly constricted at the point of attack.

The disease is only serious in wet weather, and on land on which plants of *Leucaena glauca* or *Phytolacca octandra* have been growing for some time.

The dead plants should be lifted and destroyed and replaced by seedlings which are older than those normally used for transplanting, and watered only once directly after planting. The planting hole should be deeper than usual and should not be filled in for about a week.

(*c*) Collar disease caused by *Sclerotium Rolfsii.* This disease usually appears soon after transplanting and corrodes the bark in as far as the wood of the stem just at and below soil level.

The disease is easily identified by the white mycelium, covered with small, white or brown sclerotia, which is attached to the stem.

The disease is said to cause little damage, but it is likely to be more serious in land formerly used for the cultivation of Jerusalem artichoke, or groundnuts.

(*d*) VARIEGATED LEAVES. Sometimes plants appear with variegated spots in the leaves, so that occasionally the leaves are almost white. These leaves remain variegated during and after curing and so are valueless. The phenomenon is hereditary and consequently seed should not be collected from such plants.

Summary.

Some local diseases of tobacco are described and control measures recommended.

Brief mention is made of diseases which have not yet been recorded in Malaya, but are probably present and are likely to require investigation if tobacco cultivation extends.

SURVEY OF CULTIVATED FRUITS IN PAHANG 1933

BY

J. W. JOLLY,

State Agricultural Officer, Pahang.

Towards the latter part of 1932, a preliminary fruit survey was conducted in the District of Temerloh, Pahang. In this instance one holding only was examined from each mukim.

As a result of the information obtained, it was decided to extend operations during 1933 to embrace all Districts in Pahang and, where possible, to increase the number of holdings examined to four from each mukim. At the same time, a census of cultivated fruits was undertaken and has revealed the presence of a very much larger acreage than that previously estimated.

Methods Employed.

Pahang is divided into six administrative districts, each of which has been examined separately. A total of 224 holdings were inspected, representing an average of slightly less than four holdings from each mukim.

The distribution of number of holdings examined is as follows :—Lipis 56, Raub 28, Bentong 12, Temerloh 60, Pekan 60, Kuantan 8.

A field form similar to that utilized for the Malacca Survey was prepared, but it was found necessary to apply certain modifications to meet local conditions.

Each of the holdings selected was examined by the Malay Agricultural Assistant in charge of the District, who recorded the information on the field forms. Re-surveys were performed from time to time in order to check the work as a result of which it was found that the information recorded was reasonably accurate.

Information Sought.

The principal information sought was as follows :—

(*a*) The average size of fruit holdings and to what extent acreage varies according to proximity to market.

(*b*) An accurate estimate of the actual acreage of cultivated fruits.

(*c*) The average yield per acre of the various cultivated fruits.

(*d*) The estimated cash return per acre from the various Districts.

(*e*) General condition of cultivation.

(*f*) To obtain information as to what districts would be most likely to benefit from increased fruit cultivation.

(*g*) Districts from which a surplus of fruit is invariably produced.

(*h*) Districts which produce insufficient or only just sufficient fruit to satisfy their own requirements.

(*i*) What marketing facilities exist for the disposal of surplus fruits.

In newly planted holdings more attention is paid to cultivation and this may be attributed largely to the practice of cultivating catch crops such as banana, pineapple, sugar cane, tapioca and miscellaneous vegetables during the early growing period of the main crop.

As a result of the census of areas of cultivated fruits taken, excluding coconuts, pineapples and bananas, it has been found that very great discrepancies have occurred in past returns, the total planted acreage being 4117 acres as against the previous estimate of 1065 acres.

There is some considerable variation in yields per acre of the cultivated fruits as amongst districts and it is not considered that, in many cases, this information can be treated as being more than very approximate. Considerable difficulty was experienced in obtaining any information on this matter as cultivators generally appeared unable rather than unwilling to estimate past returns. In order to obtain reasonably accurate yield figures, a smaller number of holdings have been selected from each district and actual yields are to be recorded over a period of years.

General Information Obtained.

Size of Holding and Density of Planting.

Practically all Malay holdings possess a few varieties of fruit, but fully-planted holdings are, as a rule, only met with in Districts situated in close proximity to a ready market.

The fruits most commonly planted are shewn in Table II. The number of holdings on which the chiku, (*Achras sapota*), pulasan, (*Nephelium chryseum*) and duku, (*Lansium domesticum*) were found under cultivation was so small as to render impossible the inclusion of these types amongst the local cultivated fruits. These fruits find a ready local market and there is room for a limited expansion in their cultivation.

The size of holdings varies from under 2 to 4 acres, but is usually between 2 and 3 acres in extent. Proximity to a market does not necessarily mean larger holdings as is shewn by the fact that the average size of holding in Bentong situated near to a ready market is 2 acres, while in Lipis with a less ready market, the average size of holding is 2.25 acres. The average size of holding in other Districts is as follows :—Raub 2.25 acres, Temerloh 1.75 acres, Pekan 4 acres, Kuantan 2.75 acres.

The larger average size of holding shewn for Pekan is due to the inclusion of a number of relatively large holdings situated in the vicinity of the town of Pekan, and it must not be assumed that holdings in this District are generally larger than obtain in other Districts.

In areas situated close to markets, the density of cultivation is much greater than is the case in holdings not so favourably situated.

Condition of Holdings.

Planting is usually of a haphazard nature and, undoubtedly, a very considerable number of trees in the older plantations are self-sown. On more recently planted holdings, however, attention has been paid to lining and holing.

With a few exceptions, fruit holdings once established are almost entirely neglected, no cultivation in any form being practised. In some instances, however, new plantings receive some care during the early stages of growth. Excessive undergrowth is periodically cut back and, in some cases, attempts are made to protect the crop from the ravages of pests, such as squirrels. Manuring is seldom practised on mature holdings, except where livestock are allowed to roam over the holdings and thus to supply a small amount. Rubbish, grass cuttings and ashes are, in some cases, used to fertilise new plantings.

Knowledge of marcottage is fairly general, but with a few exceptions, has not been practised to any large extent.

The demand for good fruit stock is increasing, but the actual number and variety of plants ordered indicate that cultivation is intended for home consumption rather than for marketing purposes.

Marketing.

Most surplus fruit, if sold, is disposed of at the roadside to travelling dealers. The unit of production, with few exceptions, is too small to allow of good prices being obtained, but in the case of roadside sales, this is sometimes overcome by producers arranging to take their produce to a definite place on a certain date, thereby obviating the necessity for a dealer to visit several places before he can obtain sufficient supplies to meet his requirements.

Marketing facilities are extremely poor and the producer is entirely at the mercy of the buyer, but it must not be overlooked that the buyer in Pahang often takes greater risks than is the case in other parts of the country. As an example, lorry drivers returning to Kuala Lumpur with only a small load or no freight at all, often purchase considerable quantities of fruit, which they hope to sell at a profit on arrival in Kuala Lumpur.

The practice of bringing all produce to certain places along the roadside for sale results in slightly better returns to the producer, as the purchaser can than obtain his requirements from one or two centres and thus save both time and money. No attempt at co-operative selling is undertaken in conjunction with this form of collective selling, each cultivator disposing of his own produce, but the mere fact that the purchaser has a number, instead of one individual to deal with, reacts to the benefit of the producer.

The formation of "Weekly Fairs" has improved the marketing facilities. This is most noticeable in the case of the very small producer, whose crop would be insufficiently large to warrant the expense of transporting it to any of the larger markets. Retail prices in the local town and village markets are invariably higher than prices at "Weekly Fairs".

Table I.

Order of Popularity of Fruits as amongst Districts and Percentage of the Total Holdings on which Individual Fruits are Planted.

LIPIS		RAUB		BENTONG		TEMERLOH		KUANTAN		PEKAN	
	%		%		%		%		%		%
Coconut	94	Rambutan	100	Banana	91	Coconut	100	Mango	87	Coconut	96
Langsat	91	Durian	96	Jack Fruit	91	Jack Fruit	78	Rambutan	75	Mango	83
Durian	87	Banana	93	Coconut	83	Rambutan	75	Durian	75	Jack Fruit	76
Rambutan	82	Coconut	89	Rambutan	83	Mango	68	Rambai	75	Rambutan	71
Jack Fruit	78	Langsat	89	Durian	83	Banana	66	Coconut	50	Mangosteen	68
Mangosteen	75	Mangosteen	85	Mango	75	Mata Kuching	56	Mangosteen	37	Banana	68
Bachang	64	Bachang	78	Mangosteen	66	Langsat	53	Jack Fruit	37	Rambai	66
Mata Kuching	64	Mata Kuching	78	Pineapple	66	Durian	50	Bachang	37	Jering	56
Mango	63	Jack Fruit	75	Bachang	66	Bachang	46	Langsat	25	Bachang	53
Pomelo	60	Rambai	71	Jering	66	Mangosteen	41	—		Durian	50
Jering	53	B. Buloh	60	Langsat	58	Rambai	41	—		Pineapple	33
Blimbing Buloh	52	Jering	57	Rambai	58	Pomelo	33	—		Pomelo	31
Rambai	51	Pomelo	50	B. Buloh	50	B. Buloh	33	—		B. Buloh	20
Banana	50	Mango	39	Pomelo	50	Jering	21	—		Langsat	10
Pineapple	25	Pineapple	25	Mata Kuching	33	Pineapple	16	—		Mata Kuching	6

Table II.

Fruit Survey, Pahang.

Average stand of fruit trees and estimated yield and cash value of crops.

Name of Fruit	Yield stated in terms of	LIPIS DISTRICT			RAUB DISTRICT			BENTONG DISTRICT			TEMERLOH DISTRICT			PEKAN DISTRICT			KUANTAN DISTRICT		
		Average Number Plants Per Acre	Average Yield Per Acre Per Annum	Gross Cash Value Per Kampong $	Average Number Plants Per Acre	Average Yield Per Acre Per Annum	Gross Cash Value Per Kampong $	Average Number Plants Per Acre	Average Yield Per Acre Per Annum	Gross Cash Value Per Kampong $	Average Number Plants Per Acre	Average Yield Per Acre Per Annum	Gross Cash Value Per Kampong $	Average Number Plants Per Acre	Average Yield Per Acre Per Annum	Gross Cash Value Per Kampong $	Average Number Plants Per Acre	Average Yield Per Acre Per Annum	Gross Cash Value Per Kampong $
Cocount ...	nuts	21.8	1024	25.62	16.0	1024	20.48	23.08	715	21.45	23.10	1155	8.00	35.20	2647	26.50	10.1	30	3.03
Mangosteen ...	fruits	1.0	450	1.32	1.9	665	1.66	1.46	156	.39	.59	413	1.38	1.50	750	1.35	.5	270	.27
Rambutan ...	"	4.0	2800	2.80	7.2	94	6.58	19.25	38,500	77.00	2.01	4020	4.02	1.20	4000	2.40	2.0	1100	2.20
Banana ...	bunches	9.5	9	1.08	30.0	30	3.00	75.16	73	7.30	13.02	13	1.36	24.60	24	2.40	—	—	—
Pomelo ...	fruits	1.0	60	3.00	.5	55	1.48	.87	17	.85	.29	15	.30	.25	21	.60	—	—	—
Pineapple ...	"	6.6	6	.12	11.4	11	.11	30.58	30	.60	4.00	4	.16	44.67	44	1.32	—	—	—
Durian ...	"	3.3	742	44.50	4.5	100	45.00	7.66	1530	76.50	1.26	277	27.70	1.15	126	7.56	10.0	125	62.50
Jack Fruit ...	"	3.5	28	5.00	1.6	10	3.20	4.75	24	4.50	2.21	38	5.70	2.20	22	2.42	.8	12	1.00
Langsat ..	gantangs	7.4	133	13.30	9.2	11	15.15	12.46	498	49.80	2.71	54	5.40	.50	7½	1.08	.5	20	1.50
Rambai ...	"	.7	21	1.05	.2	18	.32	1.25	87	4.35	.61	12	.96	.85	34	1.70	1.4	40	2.80
Bachang ...	fruits	1.3	150	1.50	1.6	250	4.00	1.25	297	.90	.63	139	1.39	.42	193	.60	.2	150	.17
Blimbing Buloh ...	gantangs	.9	6	.36	.1	8	.08	.41	300	.30	.31	1	.09	.12	½	.02	—	—	—
Jering ...	fruits	.7	287	.28	.1	500	.05	1.16	1740	1.74	.23	184	.18	.57	513	.37	—	—	—
Mata Kuching ...	gantangs	1.2	18	4.50	3.4	12	13.65	1.00	70	14.00	1.31	33	6.60	.20	5	1.00	—	—	—
Manggo ...	fruits	1.9	190	1.90	.1	130	.06	2.26	1380	13.80	1.41	570	2.85	1.22	732	1.83	3.8	275	5.25
Total ...		6.48		106.36	87.8		114.82	180.60		273 78	53.42		66.09	114.65		51.15	29.3		78.79

Grading of produce is never undertaken and it is extremely doubtful whether, with the present marketing conditions, grading would result in any increased returns but, if any improvements are to be attained, some degree of grading will be found essential.

Organised co-operative sales—other than collective sales at roadside—have never been attempted.

The cash returns per acre appear high owing to the high yield figures given. Undoubtedly, a very useful additional income can be obtained from fruit holdings situated close to a ready market and this fact has undoubtedly been recognised by producers as is shown by the density of cultivation on such areas, when compared with other more isolated districts.

It has been stated that practically all Malay holdings include a certain amount of fruit cultivation, but there is one rather curious exception which occurs on the East Coast of Pahang. In most of the mukims south of Kuala Pahang the main source of income is derived from fishing and little if any attention is paid to agricultural undertakings, but the mukim of Endau, which is the most southerly of the coastal mukims, possesses fairly extensive areas of fruit cultivation, the surplus from which is disposed of in the mukims of Pontian, Rompin and Bebar where fruit cultivation is entirely lacking.

Little if any reliable information on the question of indebtedness of cultivators is available, individuals generally being disinclined to reveal such personal matters. The general impression formed is that indebtedness is not excessive.

Conclusions.

There is not scope, under existing conditions of population, for immediate large-scale expansion in fruit cultivation; as the country develops, however, gradual and continuous expansion should take place. At present, opportunities exist for small-scale expansion and particularly for the introduction of certain types of fruit at present sparsely cultivated and for which a ready market exists.

There exists a demand for good planting material of good types and every endeavour should be made to meet this demand for new plantings.

Cultural methods leave much to be desired, but there are indications of a very slight improvement as a result of past teaching and persuasion.

The marketing of small-holders' fruit, as of other produce, leaves much to be desired, but it appears that any general improvement can be obtained only by a Malayan campaign, as any attempt to improve conditions in any one District—or for that matter State—would come up against the interests of the middleman and retailer and would therefore be likely to suffer a boycott if supplies were available from other sources.

THE LAYOUT OF FIELD EXPERIMENTS

BY

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The results of field trials and their significance are frequently recorded in this Journal; the object of these notes is to explain why modern field trials are made along certain defined lines and what type of result is to be looked for.

A field trial has always the some object in view, namely, to ascertain whether one variety or strain of plant, or operation such as manuring, cultivation, drainage, spacing, method of sowing or pollination is better than another used under similar conditions.

For convenience in the following discussion the word "treatment" is used to cover any of these.

No field trial can give absolutely certain results. All that can be done is to arrange matters so that the *probabilities against* an increase or decrease shewn by one treatment over another being due to chance shall be great enough to amount to practical certainty under the particular conditions of the experiment. For general purposes it is considered sufficient that this chance should be five in one hundred.

Simple Layouts.

The simplest possible form of trial is one in which some one treatment is compared with a control in a contiguous plot without repetition.

Let it be supposed that the treatment does in fact yield twice the crop of the control. This increase may be due to treatment but might as easily be due to differences in the original fertility of the two plots. There is nothing in the results to shew which is the cause of the difference. Some light would be thrown on the matter by repeating the experiment with the plots reversed, but as the new control plot had undergone a treatment previously, the issue would be confused. An alternative might appear to be to record yields in the first season and use these for controls for the next. The great objection to such a course is the unknown effect of the season on the plots. With differing conditions of temperature and rainfall, the results of the first season's observations might be confuted by the results obtained by a second season of such preliminary observation. In any case, by either of the methods considerable time is wasted.

Variation.

Let it be supposed that an experiment is concerned with a square piece of land 1 acre in area divided in one direction only (horizontally or vertically) into eight strips, the first four of which are control and the second four manured.

(i) If the fertility is phenomenally even and all the control strips give the same results as each other exactly, as do also the manured strips, then the results so obtained are merely those obtainable by dividing the area into two halves only. The effect of this is considered below, under "size of plot".

(ii) If the fertility is such that it increases from plot to plot as one passes from the extreme control plot to the extreme treated plot then undue bias will be given to the manurial results while in the converse case the effect of the manure will be partially masked.

(iii) If the fertility is not even, then the control and manurial results will vary amongst themselves and a further problem arises, how to estimate the value of the manurial effect compared with these phenomena of variation. A high result in a control strip, or a low result in a manured strip, will obviously affect the utility of the average. Further, differences in results may be due to pests and diseases, both of which have a similar effect to differences in fertility. The experiment, therefore, must be laid out in such a manner that these phenomena of variation may be allowed for in any subsequent mathematical examination of the utility of the average or mean.

Randomisation.

In (ii) above it was supposed that the fertility increased across the strips and although it lent a bias to the results it was nevertheless recognisable. If, however, the direction of fertility had been along the strips it would have passed unrecognised.

In laying out an experiment it is unlikely that it will be known in what direction this fertility drift will lie, but its presence will be observed if each strip is divided down its length into a number of plots, and these harvested separately, for then the fertility differences will become apparent no matter what is the general direction of the drift. An easier way appears to be to compare each treatment plot with the mean of the control on either side and this, in point of fact, has been advocated. The objection of such a method lies in the fact that if more than one treatment is considered the number of controls required is greatly increased.

The fertility variation is not likely to be graduated throughout the experimental area, but is likely to lie in patches; in cultivated soil as found in the farm lands of Europe, such patches are likely to be evenly distributed. On local soils which have not been subjected to centuries of cultivation—whether virgin jungle or carrying crops—the distribution is likely to be uneven.

To overcome this difficulty of patches of differing fertility, randomisation is resorted to, *i.e.* the treatment to be accorded to any given plot is chosen at random. Certain restrictions are frequently made, one of which is that if

RANDOMISED PLOTS

A	D	E	D	E
C	B	E	D	D
B	B	A	C	C
E	B	C	A	A
D	B	A	E	C

LATIN SQUARE

B	A	D	C	E
A	C	E	D	B
D	B	C	E	A
E	D	A	B	C
C	E	B	A	D

RANDOMISED BLOCKS

D	A	E	B	C
B	D	A	C	E
C	A	D	B	E
B	A	E	C	D
D	A	E	C	B

EXAMPLE OF COMPLEX EXPERIMENT CONFORMING TO THE LATIN SQUARE TYPE

A N PK NP NPK	D PK N NPK NP	B NPK NP N PK	C NP PK NPK N
D NP NPK PK N	C N PK NP NPK	A NP PK NPK N	B PK N NP NPK
C PK N NPK NP	B NPK NP N PK	D N NPK PK NP	A NPK NP N PK
B NPK NP PK N	A NP NPK PK N	C PK N NP NPK	D N NPK PK NP

possible, the number of control plots should be the same as the number of plots of any one treatment. This is not essential to the experiment, but is of great utility in simplifying the subsequent mathematical examination.

It frequently happens that the fertility patches (or gradients) are fairly large and while randomisation is necessary for the smallest units into which the experiment is to be divided, these large changes can often be dealt with, to some extent, by dividing the area into blocks in the expectation that differences in fertility will shew up in the differences of total yield for each block.

By dividing the area into blocks, fertility differences are eliminated in one direction only as will be seen from the accompanying diagram. Greater accuracy would be obtained if the blocks can be arranged in two directions. The best method of doing this is by the so-called Latin square arrangement in which the experimental area is divided into the same number of blocks in the horizontal and vertical direction as shewn in diagram. It need not necessarily be square in shape but it is essential that it shall be subdivided into the same number of plots in each direction. In order to distinguish the division into blocks in each direction, the horizonal division is spoken of as rows and the vertical division as columns. It so happens, in addition, that the total number of plots into which it is to be subdivided is usually the square of the number of treatments.

Within the block or within the column or row of the Latin square, the principle of randomisation will still hold, with the restriction that all treatments appear in each column and row or block the same number of times.

Analysis of Results.

Before proceeding to a discussion of such an analysis it is necessary to introduce the word "replicate", which is a term used to cover, in general phraseology, an undefined number of repetitions. If a treatment occurs three times then it is natural to speak of triplicates. Replicate cover all numbers.

How is the variation from plot to plot of the same treatment to be taken into account?

Since in Nature exact agreement of replicates can never be obtained, what is wanted is an estimate of the reliability of the means of the replicates of each treatment. As an example, suppose that the two following series are the results obtained.

$$1,\ 2,\ 1,\ 12 \qquad \text{mean} = 4$$
$$3,\ 4,\ 4,\ 5 \qquad \text{mean} = 4$$

The mean in each case is 4, but no one would hesitate in placing more reliance on the latter than on the former. A series of results in which differences from the mean are great should be made to carry less weight than a series where the individuals lie close to the mean.

This could be done, possibly, by summing differences from the mean, neglecting the $+$ or $-$ sign and dividing by the number of observations and calling it an error factor. For the above two series this would be

(*a*) $(3 + 2 + 3 + 8)/4 = 4.0$
(*b*) $(1 + 0 + 0 + 1)/4 = 0.5$

It is obviously possible to plot a curve, for any given series of results, of the values taken by the series against the number of times these values occur.

It can be shewn that, when the series can take any value (as against a discontinuous series), the frequency with which any value occurs will depend on the square of the difference of that value from the mean. Such a series is said to be normally distributed.

Consideration of the above two series will shew that such a curve can vary in its slope. What is wanted therefore is some non-graphical means of estimating this slope—or conversely, the extent to which values are scattered.

From the mathematical properties of this curve of normal distribution it can be shewn that the best estimate of scattering is given by the expression

$$\sqrt{\frac{\Sigma\ (m\text{-}x)^2}{n}}$$

This expression is called the standard deviation and is usually written as σ "m" is the mean, "x" is any observation and "n" is the number of observations. Examination of the form of σ shews that the less the observations differ from the mean (the steeper the curve) the smaller the standard deviation, for in order to estimate σ each observation in a series is taken from the mean in turn and the difference is squared. The squares so obtained are added together and divided by the number of observations; finally the square root is obtained.

Further, the standard deviation provides an estimate of the reliability to be placed on the results; it is a measure of the likelihood of any result differing from the mean by a given quantity. It is possible to find the odds against any deviation from the mean (for example say 10 per cent.) exceeding a certain quantity by chance. The usual standard adopted is twenty to one *i.e.* only five times in a hundred that such results shall be chance ones.

σ has been derived from the curve for normal distribution.

In the case of a small series of observations, it is found that a better estimate of the standard deviation is obtained by dividing by "n—1" instead of "n".

Taking the two series above the standard deviations would be

(a) $\sqrt{(3^2 + 2^2 + 3^2 + 8^2)/(4\text{-}1)} = 5.4$ (approx.)

(b) $$\sqrt{(1^2 + 0 + 0 + 1^2) / (4-1)} = 0.81 \text{ (approx.)}$$

The practical analysis of all experimental results in agriculture rests on the foregoing.

The researches of Fisher and others shewed that the variation in a field experiment could be divided into a number of parts and the residual variation could generally be reduced by eliminating variation due to known controllable factors. Field experiments may be grouped as follows :—

(*a*) Those in which there is complete randomisation of plots.
(*b*) Those in which plots are grouped into blocks.
(*c*) Those in which plots are grouped into a Latin square.
(*d*) Complex experiments in which two or more *types* of treatments are being studied simultaneously.

(*a*) If one treatment only were used in an experiment, no matter how many plots the land were divided into, it is obvious that all the variation which occurs would be due to differing fertility of the soil or individual plant differences. Such variation is spoken of as random or residual variation. If, however, there were two or more treatments, it is as evident that part of the variation is due to inherent differences between treatments. The residual variation, therefore will be the difference between the variation caused by treatments and the whole variation.

(*b*) In the case of experiments laid out in blocks, the total variation will be due not only to the causes outlined under (*a*) but also to the variation between one block and another, so that the residual variation will be the total variation less the variation due to treatment and the variation due to division into blocks.

(*c*) The same arguments apply to the Latin square, with the additional possibility of further reducing the residual or random variation by subtracting the variation due to columns.

(*d*) The complex experiment may conform to any of the above forms, but it is designed to answer more than one *type* of question at once *e.g.* the effect of cultivation and manuring.

In all the above cases it is desired to compare this residual or random variation with that due to treatments. In the case of the complex experiment this still holds good, but the variation due to treatments can itself be split up into separate parts due to each type of treatment and interaction between the types.

The usual estimate of the residual variation is called the random error and is in effect the Standard deviation of the residual variation.

Field experiments are not usually concerned with a single series, but are designed to answer the question of the reliability to be placed on differences of a number of treatments. The random error may be regarded as a measure of this. In order that one treatment may be considered significantly different

from another, it is necessary that the difference of their means should exceed the random error by an amount such that this excess could only occur by chance five times in one hundred trials.

For details of the working out of the random error by the elimination of variation due to blocks, treatments, etc. consultation should be made of the analysis of variance in R. A. Fisher's Statistical Methods for Research Students.

The Size of Plots and the Number of Replications.

A decision has always to be made, primarily, as to the size of the individual plots to be used and this will depend, to an extent, on the type of crop which is being studied, for with seasonal crops a large number of plants can be put in a comparatively small space compared with a permanent tree crop such as oil palm. Two factors are concerned, the larger degree of accuracy obtained from a larger plot owing to the fact that a larger number of plants approximate to the mean, a smaller degree of accuracy obtained owing to greater variations in soil the larger the plot. The most convenient way of determining this plot maximum in the first place is by preliminary observation of individual yields, in the case of crops such as oil palm, or of very small plots in the case of such annuals as rice.

From these observations an estimate may be made of the Standard deviation as defined above. Then from the same series of observations, by combining contiguous palms or plots, it may be determined up to what size of plot the standard error is continually and usefully reduced.

It is usually considered sufficient that the standard error should be below ten per cent.

It was pointed out above that in the Latin square type of experiment the number of replications is normally controlled by the number of treatments; in the case of a randomised block no such control exists but it will be realised that some determination must be made of the number of replications.

Still considering the standard error, it can be shewn that in a preliminary observational experiment with only two replicates, the standard error will be similar to the standard deviation and will be composed of the square root of the sum of squares of difference of the two replicates from their mean, divided by one.

If there were three replicates, the standard error would be the sum of the squares of the difference of three replicates from their mean, divided by two *et seq.*

Assuming that the differences from the mean are the same order in each case, the comparative figures for the standard error are shewn in tabular form below.

No. Plots	2	3	4	5	6	7	8	9	10
Comparative S.E.	1.00	0.85	0.82	0.79	0.77	0.765	0.757	0.750	0.746

From these figures it will be seen that whereas there is a drop of fourteen per cent. between two and three replications, there is only a drop of seven per cent. between three and five replications and a half per cent. between five and seven.

Hence there appears little to be gained by increasing the number of replicates beyond four or five.

(The process may be extended to cover more than one treatment).

The Effect of Seasons etc.

It should be quite clearly understood that the results of a given experiment only apply strictly to that experiment.

Different seasons might have a marked effect on a given experiment owing to the different reaction of different manures, varieties etc. to drought or excess rain or variations of light and heat.

If, therefore, very exact results are looked for, it will be necessary to repeat the same experiment over several seasons.

The seasonal means themselves can be submitted to a statistical analysis.

On the other hand, it must not be assumed that one season's trials are not very valuable. Difference of treatment may be so large as to leave little doubt of the significance in the case of annuals. In the case of permanent crops, in particular, it will be realised that even if the results for one season are highly positive, observations must be continued not only in order that the effect of differing amounts of rain, drought, light and heat may be studied, but also to obtain some idea as to the period of time over which a given treatment will be effective. Even such an observation as the latter may be repeated a number of times and these results of observations of the period of effective treatment can be analysed statistically.

Miscellaneous Articles

EXPORT MARKET FOR MALAYAN BANANAS.

The marketing of Malayan bananas in the United Kingdom is a trade that has been frequently suggested. It is as well therefore that those who contemplate development in this direction should be in possession of the facts. Readers of this journal who live in other tropical parts of the world, will appreciate exactly how far the conditions obtaining in Malaya are applicable to their particular circumstances.

The subject of banana export has recently invited renewed attention owing to the increased demand for the fruit in the United Kingdom. Shortage of supplies is the result of the recent hurricanes in the West Indies and of the incidence of Panama disease.

Incidence of Disease.

Panama disease, (*Fusarium cubense*), has been the cause of considerable anxiety in the West Indies since 1912, and it is estimated that in Jamaica, 15,000 acres have been lost to banana cultivation by infection, isolation under quarantine, or abandonment. Jamaica is combatting this disease by strict quarantine of infected areas and by raising immune varieties of bananas to replace the susceptible Gros Michel now generally grown throughout the Island.

Panama disease has been found in various parts of Malaya, but owing to the fact that there are several good commercial varieties which are not as yet affected with the disease, there is no immediate cause of alarm. Should, however, banana cultivation be extended for the purpose of export, it would be necessary to select a variety which is immune to Panana disease and which is acceptable on the market. The varieties which have proved to be most susceptible to the disease are Pisang Embun (the most important variety), Pisang Restali and to a less extent, Pisang Talon. Of those that are resistant or immune may be mentioned Pisang Mas and Pisang Serendah, the latter being one of the Cavendish forms. The wild varieties of the banana in Malaya (*Musa malaccensis* and *Musa violescens*) have not, up to the present time, been found attacked by the causal organism of Panana disease. If further investigation confirms this immunity, its usefulness in cross-pollination for the development of resistance in some of the desirable banana varieties which exist in the country suggests itself.

Transport Difficulties.

The second point to be considered is the distance of the market from the source of supply. It must be remembered that Malaya is a month's journey from England. The opinion of a prominent authority in London on this subject was sought. He states that he does not think that bananas would stand the journey. There are at present, two classes of boats running from Jamaica; one class brings the bananas in 12 to 13 days and the other in 16 to 17 days,

and the difference of the fruit is very marked. During the course of experiments with regard to another country, bananas were brought to England in good condition after a 28 days' voyage at 52—53°F. but they could not be made to ripen properly. Accordingly, if specially fitted ships were available to carry bananas from Malaya, the fruit would probably arrive in good condition, but would not ripen: they would just go soft and a dirty slate colour. Further, if there is any stem-rot or finger-rot in Malaya, the fruit would not arrive in good condition.

It would appear therefore, that although there is a potential market in the United Kingdom for bananas from Malaya, it is highly improbable that the fruit could be shipped to arrive in good condition.

Australian Market.

An alternative export market for Malayan bananas which has been suggested is Australia. We are indebted to H.M. Trade Commissioner, Singapore and H.M. Senior Trade Commisioner in Australia for the following information (we quote extensively from their memoranda on the subject).

The area under bananas in Australia in 1931 was 21,941 acres, whilst production therefrom was 2,728,982 bushels. Imports of fresh bananas in 1931/32 amounted to 28,721 centals (1 cental = 100 lbs.), approximately half of which were from Netherlands India.

The general tariff on imports is 8s. 4d. per cental to which has to be added surtax and primage duty. There is a preferential duty of 2s. 6d. per cental for imports of a quota of 40,000 centals of Fijian bananas. This rate does not apply to bananas imported from other British territories and any imports from Fiji in excess of the quota would be subject to the full rate of 8s. 4d. per 100 centals, together with further charges of 10 per cent. *ad valorem* primage duty, 2½ per cent. sales tax (from which local growers are exempt) and 4d. per case for inspection fees under quarantine regulations.

The preferential rate of 2s. 6d. accorded to Fijian bananas is found to be too high to permit of any profitable trade, despite the proximity of that territory to Australia, and there is little likelihood of the quota limit being reached as the trade has now virtually ceased.

From the failure of Fiji to attain their quota under the preferential tariff rate, it will be seen how improbable it is that more remote countries could develop any new trade under conditions of the full tariff rates and other charges.

The trade in bananas with Australia, hitherto carried on by Netherlands India, has been confined to Western Australia. This trade appears to have been governed by the fact that, until recently, production in Western Australia was not so large as in other States, and also by the possibility of landing fruit in saleable condition.

As the fruit ripens very quickly, every day in transit, exceeding five or six, is stated to involve an increasing percentage of loss, and with the rapid extension in production of locally-grown bananas under irrigation conditions,

growers in Western Australia are already under-selling and displacing the imported article, while it is anticipated that saturation point will be reached next year. In New South Wales and Queensland, a considerable increase in output is anticipated and warnings have been issued to growers against over-production.

With regard to the market for dried or preserved bananas, there is no trace of any past or present demand for these products. Dried bananas, under present tariff rates, would be subject to a duty of 6d. per lb., while that on preserved bananas is 3 s. per gallon British preferential and 4s. 3d. per gallon general rate.

Acknowledgments.

In the above article, extensive use has been made of a private communication received from Mr. J. G. Hibberd and also of a memorandum supplied to this Department by Mr. R. Boulter, C.M.G., H. M. Trade Commissioner, Singapore, who also forwarded to the Department a copy of a memorandum on the subject prepared by H. M. Senior Trade Commissioner in Australia. Use has also been made of Mr. F. A. Stockdale's Report on his visit to the West Indies in 1932.

The following authorities have also been consulted: Report of the Empire Marketing Board on Fruit Supplies in the United Kingdom (E.M.B. 65), Investigations on Panama Disease in Malaya by F. S. Ward (Special Bulletin, F.M.S. and S.S., Department of Agriculture, Scientific Series No. 2) and Banana Growing in Malaya and the Presence of Diseases by F. S. Ward (*Malayan Agricultural Journal*, Vol. XVIII No. 2, 1930).

ELEVENTH MALAYAN EXHIBITION.

The Eleventh Malayan Exhibition, organised by the Malayan Agri-Horticultural Association, was held at Kuala Lumpur for three days 2nd to 4th June 1934. Rain fell for short period on two days which had some effect on the "gate". The attendance was 22,588, as compared with 20,093 in 1933.

Considerable improvements were made in the layout of the Exhibition; in all section there was plenty of room for visitors to view the exhibits, while the absence of dust owing to improved flooring, added greatly to the general comfort.

The Opening Ceremony.

The Hon'ble Mr. M. B. Shelley, C.M.G., Chief Secretary to Government, in the presence of a distinguished gathering which included their Highnesses the Rulers of Selangor and Negri Sembilan, opened the Exhibition at 11 a.m. on 2nd June.

Before asking Mr. Shelley to open the Exhibition, Mr. F. W. Douglas, President, read a message of good wishes for the success of the Exhibition received from His Excellency The High Commissioner. Mr. Douglas briefly outlined the work of the Association during the past year and the main features of the present Exhibition.

Mr. Shelley reviewed recent developments affecting agriculture in Malaya. He hoped that the better position of the rubber industry caused by the new restriction agreement would not make us drift into that facile complacency with the condition of things which characterised the period preceding the depression.

Allusion was made to recent legislation concerning the Rubber Research Institute of Malaya and to the inauguration of a service of Asiatic rubber instructors who will work towards the improvement of the cultivation and produce of small rubber holdings.

In this connexion, Mr. Shelley suggested the re-introduction of competitions of small-holders' rubber at agricultural shows, which might be organised on lines similar to those of the All-Malayan Padi Competition.

Stress was laid on the value to Malaya of her other agricultural products. Of these, the vegetable oil industry and particularly with reference to coconuts, is experiencing considerable difficulties owing to the low prices for the produce. He hoped that the committee recently appointed by H. E. The Governor would find itself in a position to put forward recommendations which would help to alleviate the position.

The improved statistical position of the local rice industry was mentioned; the campaign to increase the area and quantity of rice grown in Malaya is now beginning to shew substantial results. It is anticipated that the acreage and yield returns of the present season will surpass the record set up last year. It is believed that the additional funds now available for improving present areas and developing new areas will materially assist in the further extension of the rice industry and bring Malaya perceptibly nearer self-sufficiency in the

matter of rice supplies.

The speaker drew attention to recent legislation designed to improve the pineapple canning industry of Malaya; to the padi competitions held throughout the country and to possible expansion of fruit growing.

In conclusion, Mr. Shelley stated that the work the Association is doing deserves encouragement and he therefore commended it for favourable consideration and support.

The Hon'ble Dr. H. A. Tempany, C.B.E., Director of Agriculture, thanked the Chief Secretary for having opened the Exhibition. In a short speech he stressed the importance of the coconut and oil palm industries and reminded his listeners that these two industries are passing through a period that is every bit as difficult as that which rubber experienced during the blackest days of the depression.

He considered that agricultural shows play an important part in any movement for the amelioration and improvement of agriculture. The fact that this Exhibition was larger than its predecessors indicated extending appreciation of the need for diversification of agricultural production. In endeavouring to improve the lot of the raiat, the extended planting of food crops, combined with the production of a diversified range of money crops, form the soundest policy.

Agriculture.

The agricultural section, which this year was adequately housed, was fully representative of the crops grown in Malaya. The total number of exhibits exceeded 4000. Competition in most of the classes was strong, the judges finding it necessary, in some cases, to make additions to the number of prizes offered. Perhaps the most outstanding classes—both for quality and number of exhibits—were those for copra and pineapples. The exhibits in the former class reflected the large amount of instructional and propaganda work towards the preparation of improved copra which during the past year or so has been undertaken by the Department of Agriculture. The exhibits of pineapples shewed how much alive is the Malaya canned pineapple industry and how excellent is the quality of fruit grown for this trade. The display of vegetables grown by school gardens is deserving of praise. The excellence of their exhibits indicates the very great improvement in the standard of school garden work in the past few years. In this section also was a special exhibit staged by the Cameron Highlands Society. It consisted of a wide range of fruits and vegetables grown on the Highlands. The produce was of excellent quality, the asparagus being especially good and provided a good demonstration of the possibilities of fruit and vegetable production for the local markets.

Other classes which were well represented were "gaplek" (sliced tapioca), tapioca flour, tea, coffee, kapok, arecanuts and bananas.

Apart from the display staged by the Cameron Highlands Society and the School of Agriculture, vegetables were below last year in numbers; the quality too was hardly as good.

All-Malayan Padi Competition.

This inovation proved one of the outstanding successes of the Exhibition. About 150 samples of padi, being prize-winning exhibits from fifty District shows held this year, were submitted. Each exhibit was accompanied by a certificate of origin, stating amongst other matters the area cultivated and the yield per acre obtained. As a full account of the organisation of this competition will be found in the next issue of this journal, further comment is unnecessary in the present account.

Poultry.

The poultry section was the largest in the history of these Exhibitions. A total of 582 exhibits were received, drawn from all parts of the country, consisting of 192 poultry, 161 pigeons, 152 eggs, 50 canaries and 27 cage birds.

The organiser of this section is to be congratulated on the most attractive layout of the section.

The most popular breed was the Light Sussex with Rhode Island Reds also in evidence. An encouraging feature was the fact that about 50 per cent. of the exhibits were pure bred birds, bred in Malaya; in fact the Gold Medal for the Best Bird in the Show was won by a Rhode Island Red locally bred.

The best cross-bred bird was Sussex x Rhode Island Red.

The native birds exhibited were stated to be very good—but the less said about the general quality of egg exhibits the better!

Pigs.

There were about 40 exhibits in the Pig Show, a slight increase on last year's entries. There was a considerable improvement in the standard of the exhibits. Most prizes were taken by Chinese pig "feeders" rather than "breeders", who in Selangor—from which State all exhibits were derived—make full use of the pure-bred stock at the Government Stock Farm for crossing with local breeds.

Of cross-bred exhibits the best were Berkshire x Chinese Sow, and Large Black x Poland-China.

Cattle.

This is the first occasion for some years that cattle have been included in the Exhibition. Owing to difficulties of transport and expense to the owners, Selangor provided all the entries. The Section was successful and it is hoped that the organisers will be able to extend it considerably next year.

Cats.

The Cat Show was as usual a feature of the last day of the Exhibition and attracted great interest. There were 44 entries, the largest on record. Pure bred Siamese cats form a prominent class at this annual show. In view of the excellence of this breed in Malaya and to its popularity in other countries it is surprising that the commercial aspect of Siamese cat breeding does not receive greater notice in this country.

Village Industries and Schools.

The importance of village industries in native agriculture is fully recognised by the organisers of this Exhibition, and every effort is made to popularise this Section. On the educational side one saw the exhibits from the Sultan Idris Training College for Teachers—an institution that has done much good work in bringing in the villages skilled instruction and the application of handicrafts for the production of many new and useful articles. The fact that exhibits made in Vernacular schools sell so readily at the Exhibition is proof that the educational side is working on the right lines.

In this Exhibition one not only saw—and could purchase—the articles made in schools, but there were numerous articles of all descriptions made by villagers in their own homes.

In some States, the Government organised the display and sale of the articles produced by the village industries of the State. In this connexion, mention must be made of the attractive displays from Kelantan, Trengganu, and Brunei.

It is understood that sales at the Exhibition were good—running into something like $4,000—a tangible result which should be a sufficient justification for the trouble and expense of the various organisations and Governments concerned.

Space forbids more than a passing reference to a very representative needlework section, the excellent school exhibits and to a section devoted to art and photography.

Horticulture.

The Horticultural Show was somewhat disappointing both in quantity and quality. By this statement no criticism of the organisers of this section is intended; the explanation probably is that owners of beautiful plants and flowers are afraid of damage which handling and transport may occasion.

The import of flowers into Malaya last year was valued at over $6,000, while in 1931 it was nearly $20,000. It is probable that with proper organisation, this country could entirely satisfy the present demand, while it is possible that the local demand could be increased. The Exhibition offered to cultivators at Malayan hill stations an opportunity for advertisement and for opening up new business of which they did not fully avail themselves.

Department of Agriculture, S.S. & F.M.S.

The Department staged a series of instructional exhibits in the permanent building which they share with the Rubber Research Institute of Malaya. The following account illustrates the scope of the display.

In view of recent work aimed at the improvement of native-produced copra, exhibits shewed the system of copra-grading, types of copra and models of improved copra kilns suitable for production of high grade copra from small-holdings. In addition, products manufactured from copra were shewn.

A comprehensive series of varieties of pure strain padi, produced by the Department and suitable to the varying conditions obtaining in Malaya was displayed—a collection which never fails to attract and interest Malay visitors.

Under fruit propagation, exhibits were designed to bring to notice budding and etiolation methods.

Another series of exhibits which proved of great interest were concerned with the production of the tea at Cameron Highlands. Chests of tea of different grades, information on London sales, valuation of grades and comparison with prices of tea produced in other countries, enabled the visitor to review at a glance the present position of the work of the Department in this direction.

A section of the display was concerned with poultry. Models of improved types of poultry houses were shewn, which incorporated the most recent recommendations of the Department and are especially designed to be of use in small holdings. Other exhibits in this section were drinking fountains, food troughs and trap nests. A series of wall illustrations shewed the proper methods of handling poultry and the desirable characteristics to look for in selecting and judging poultry and observing the condition of the birds.

Recent legislation in the Straits Settlements, Johore and the Federated Malay States in connexion with the introduction of measures designed to stabilise and improve the valuable canned pineapple trade in this country led the Department of Agriculture to stage exhibits illustrative of its investigations on this crop in the field, and to display samples with special reference to the proposed grading scheme. In addition, canned pineapples from countries which were actual or potential competitors with the Malayan product were shewn.

Samples of locally manufactured tobacco were staged, together with exhibits shewing different types of leaf and a model flue-curing barn.

Other exhibits were concerned with minor economic products—pepper, coffee, Brazil nut, Avocado pear, mushrooms, arecanuts and cloves. Exhibits of pigs and cattle from the Government Stock Farm were included in the abovementioned Shows concerning such livestock.

A stall was also allotted to the display of milk from the Government Stock Farm, Serdang, with graphs illustrating its high degree of purity. Samples of fodder grasses and locally-produced feeding stuffs for cattle were also included in the exhibit.

The School of Agriculture, Malaya, occupied a stand in which were shewn the work of the School, the courses of instruction and the life of the students at the School, illustrated by a cinema film. Mention should also be made of the very fine exhibit of agricultural products grown by the students at the school, which was included in the Agricultural Show.

The Department had, in addition, a publication stand from which a range of its publications in English, Malay, and Chinese could be purchased.

Rubber Research Institute of Malaya.

The exhibits staged by the Rubber Research Institute illustrated the principal activities of the various Divisions at the present time, except that no exhibits were staged by the Soils Division.

Botanical Exhibits. The Botanical Division exhibits consisted mainly of a comprehensive series of large charts and diagrams illustrating the comparative yields of budded rubber, ordinary seedling rubber and seedling rubber derived from cross pollination of certain high-yielding clones.

These charts demonstrated clearly the marked superiority in respect of yield of budded rubber and seedling rubber trees derived from seeds of high-yielding clones over ordinary unselected seedling material. The records included high-yielding material derived from Java, Sumatra and Malaya.

A very striking series of enlarged micro-photographs of the latex-bearing tissue of high, low, and medium-yielding trees illustrated important differences in the anatomical structure of the tissue which it is hoped may prove of value in the selection of high-yielding material and also in showing the reasons for variation in yield.

Charts illustrating investigations which are now in progress on various systems of tapping were also displayed, while in addition, various modern tapping systems were also illustrated by means of models consisting of small trunks on which the tapping panels were marked out.

All the charts and diagrams were accompanied by printed narratives describing their essential features.

Pathological Exhibits. The exhibits of the Pathological Division were divided into two; *viz.* (*a*) Root Diseases of the Rubber and (*b*) *Oidium Heveae* Leaf Disease, which represent at the present time the two major activities of the Division.

Numerous specimens of the three principal root diseases—*Fomes lignosus* (White Root disease), *Ganoderma pseudoferreum* (Red Root disease) and *Fomes Noxious* (Brown Root disease) on actual rubber tree roots and also on jungle stumps from which the original infections are caused were staged. The whole exhibit was displayed with a view to illustrating the principal similarities of these root diseases. Printed narratives describing the origin of the diseases, their method of spread and treatment in young and old rubber areas were attached, so that visitors desiring information could readily obtain this from the narratives and the method of lay-out.

Considerable progress in the investigation of these diseases has been made recently at the Institute and the exhibits demonstrated the results obtained and illustrated the methods of treatment advised.

In relation to the leaf disease, caused by the Mildew fungus—*Oidium Heveae*—specimens of rubber tree leaves attacked by the fungus were shown, together with specimens under the microscope and enlarged micro-photographs.

Four of the dusting machines already used on estates in Malaya for treatment or control of the disease by sulphur dusting were displayed, together

with a series of samples of various commercial grades of sulphur powder which have been used for spraying or dusting. Photographs of the sulphur dusting machines in action were also displayed.

Chemical and Technological Exhibits. The exhibits of the Chemical and Technological Divisions may be divided into three, *viz.* (*a*) Latex Exhibits showing one of the principal defects, such as discolouration of the product due to contamination with iron.

In this section also were shown some of the principal non-rubber constituents of latex which have been isolated. (*b*) A complete factory lay-out for the preparation of either air-dried or smoked sheet. (*c*) A comprehensive series of rubber articles, manufactured direct from latex, including a few special articles such as rubber floorings and buckets made direct from raw rubber.

The latex exhibit illustrated recent important investigations carried out at the Institute on discolouration and stability of latex. Excellent specimens of air-dried sheet prepared by a special coagulant from ammoniated latex were also exhibited.

The model estate factory lay-out consisted of bulking and settling tanks, various types of coagulating tanks showing lay-out, a complete working model of a line-ahead sheeting battery (constructed by a local firm)—driven by means of a ½ H.P. electrical motor, and a model of a modern combined hot-air drying and smoke house including dripping and drying racks designed at the Institute and constructed by the same firm.

The essential features of this drying cum smoking house, consist of two chambers in each of which sheet rubber of not more than ⅛ inch thickness can be completely dried or dried and smoked in 48 hours.

A smoked sheet of good deep colour can be prepared by passing smoke for not more than 3 hours in toto into the drying chamber during the 48 hours, drying period.

A series of manufactured articles made direct from latex were included. These articles illustrated a few of the numerous recent applications of latex.

Co-operative Poultry Products Ltd.

The Co-operative Societies Department staged an exhibit of the apparatus used by this Union of Co-operative Egg-Collecting Societies for testing and grading the eggs which are being marketed in several towns of the Peninsula.

In this exhibit explanation and demonstration was given of the methods of candling eggs for freshness and of grading eggs for size and weight. The explanation was supplemented with diagrams and illuminated photographs.

The apparatus on show was similar to that used by the various Co-operative Societies affiliated to this marketing organisation. For nearly three years the Societies have been running efficiently and the apparatus is used by peasants with uniform and satisfactory results.

The Society operates from the Krian District of North Perak where the eggs are collected, candled, graded and packed. The Society has made arrange-

ments for sale of its eggs in Penang, Parit Buntar, Ipoh, Telok Anson and Kuala Lumpur.

Cinema.

As in past years, the staff of the Rural Lecture Caravan showed the propaganda films of the Agricultural, the Co-operative and the Health Departments.

An innovation was introduced this year. By means of a large ground glass screen, daylight shows were given both morning and afternoon at 11 a.m. and 4 p.m. respectively.

This screen was also used by officers of the Agricultural Department to give lectures on Poultry illustrated with lantern slides. The advantage of this arrangement is that the Lecturer can be seen by his audience and can himself see his audience whilst giving the lecture. Attendances at these daylight shows were rather poor because the public has not yet become accustomed to the times of daylight shows and it will be necessary to advertise more vigorously on future occasions.

The continuous evening film shows commencing at 7 p.m. were, as usual, very well attended.

Trade Section.

The Trade Section, which occupied almost the entire main permanent building, proved a great attraction. One is glad to note that although many exhibits were unrelated to agriculture, yet the great majority of firms in this country who trade in goods of an agriculture nature—such as machinery and fertilisers—were exhibitors on the present occasion.

Other Government Departments.

In addition to the Department of Agriculture, three other Government Departments staged exhibits. The Public Health Department has a permanent building of its own at the Exhibition, in which it staged a comprehensive series of instructional exhibits illustrative of the work of the Department.

The Posts and Telegraphs had on view the automatic exchange which will be installed at Ampang at the close of the Exhibition. The work of this exchange and that of a robot fault-finder was viewed by large crowds daily.

The F.M.S. Railway Department exhibited the latest type of second class carriage for day and night travel. The publicity provided should do much to popularise night railway travel by second class passengers, for at a very small extra charge they are provided with a well-appointed sleeping berth—complete with mosquito net!

This cursory record of the Exhibition would be incomplete without some word of appreciation of the Malayan Agri-Horticultural Association and of those ladies and gentlemen who assisted the Association in many ways to make the event a success. To these, to the Association and to individuals concerned with the constant entertainments, such as football, bicycle races, badminton tournament &c. we offer congratulations.

DISTRICT AGRICULTURAL SHOWS.

Lower Perak Agricultural Show.

The Lower Perak Branch of the Malayan Agri-Horticultural Association held an Agri-Horticultural Show at Teluk Anson on 28 April, 1934. In the absence of H.H. The Sultan of Perak the Show was opened by The Hon'ble The Raja Muda of Perak, C.M.G., M.F.C.

The Schedule contained 162 classes divided into 9 Sections.

Many exhibits were of a good standard, but also many fell short of exhibition standard—possibly on account of the fact that no show has been held for some years past.

One hundred and sixteen entries were received for the All-Malayan Padi Competition from which three samples were selected for competition at the State Padi Show and for subsequent despatch for competition at the Eleventh Malayan Exhibition.

The Village Industries Section was well supported and contained a large variety of articles of good workmanship.

The Department of Agriculture staged an exhibit of padi, copra and tea. The Drainage and Irrigation Department staged a model of the first section of the Sungei Manik Irrigation Scheme, an exhibit that attracted considerable attention. The Health Department staged a well-arranged exhibit and organised a Baby Show. The Sultan Idris Training College displayed a wide range of various articles, from attractive lamp shades to specimens of the soap manufactured by the College. The Teluk Anson Malay School also displayed good specimens of its pupils' work, including paintings and hand-work of various sorts.

Not only was the Show well supported in the matter of entries, but it was well attended throughout the day. The Hon'ble the British Resident attended the Show and distributed the prizes in the afternoon.

Bukit Mertajam Agricultural Show.

This show was organised by the District Economic Board, Province Wellesley under the Chairmanship of the District Officer, Province Wellesley.

Owing to the very large number of entries in the All-Malayan Padi Competition, preliminary judging was carried out in the small-holdings, any manifestly bad samples being rejected. Even so, upwards of 100 samples of padi were exhibited at the Show. The general quality was only average and did not compare well with the standard in Penang.

Agricultural and other produce was exhibited in 90 classes, arranged in 8 Sections. The general standard of the agricultural exhibits was very good and it is anticipated that if a similar show is held next year, the number of entries will be greatly increased, since great local interest was aroused by this event,

The Department of Agriculture displayed samples of padi with descriptive cards indicating the qualities to be aimed at for the purpose of the All-Malayan Padi Competition, mushroom cultivation and methods of rat destruction. The Health Department had an extensive series of exhibits devoted to rural hygiene.

About 2000 people attended the Show and local opinion is extremely favourable to the holding of a similar event next year.

Kelantan Agricultural Show.

The second Agricultural Show held in Kelantan took place on 19th May, 1934, at the Central Experimental Station, Kota Bharu.

The number of classes was increased from 30 last year to 41 on this occasion, these being divided into six Sections, one of which was devoted to exhibits from schools.

With the exception of "Miscellaneous" all Sections were well filled and the standard of the winning exhibit was most encouraging.

His Highness the Sultan visited the Show and was keenly interested in the various exhibits, particularly in the display of improvement in smallholders' rubber, fodder grasses, copra improvement, padi, and plant propagation methods staged by the Department of Agriculture.

The Malayan Agri-Horticultural Association kindly donated 6 medals and 6 diplomas. One of the five medals was awarded to the best exhibit in each Section and a certificate to the best exhibits from schools. A silver medal was awarded to the headman of the District which obtained the greatest number of awards.

Temerloh Agricultural Show.

A very successful show, at which His Highness the Sultan of Pahang was present, was held at Temerloh on May 19th. Both the number and quality of the exhibits were on the whole very satisfactory. The entries in the padi section were numerous, though many of the exhibits consisted of somewhat mixed strains owing to the fact that news of the local padi competition could not be made known until after growers had reaped their crops and mixed the padi in the storage bins.

Though many fruits were out of season, there was a good display of pineapples, especially of the Sarawak type, and of bananas. Other prominent classes were those for coconut oil and kapok, and several for different kinds of vegetables. In all these, there were numerous exhibits of which several were of noticeably good quality.

The physical drill competition for pupils from local vernacular schools, water and field sports, were run in connexion with the Show and all were attended by a very large gathering of Malays from all parts of the District.

Departmental.

FROM THE DISTRICTS.

May, 1934.

Compiled by the Chief Field Officer from Monthly Reports submitted by Field Officers.

The Weather.

The weather during May was, on the whole, hot and dry with a rainfall definitely below the average for the month. There were, however, showers which varied considerably in frequency and intensity in different parts of the country. As a consequence the rainfall in Kedah, Kelantan, Penang and Province Wellesley and northern Perak was only a little below or nearly up to average for the month. On Cameron Highlands there were two wet spells giving average rainfall. In the south, conditions were more irregular. In Malacca rainfall was above average, though the first half of the month was dry. In Johore, Batu Pahat District received twice its normal rainfall, while in other districts conditions varied from normal to very dry. A similar variation in rainfall distribution was experienced in Singapore Island.

Remarks on Crops.

Rubber.—With the official announcement that restriction would be brought into force on the 1st. June, prices rose quickly during the first ten days of the month and there was speculative buying in some districts. Later, when it became known that restriction would be effected gradually, the price declined substantially. The lowest and highest prices in dollars and cents per picul for rubber from small holdings were:—Smoked Sheet $16 to $34; Unsmoked Sheet $12 to $31.50; Scrap $2.50 to $16. Penang prices for Unsmoked Sheet ranged from $24 to $31.50 as compared with $20.50 to $24 in April.

General conditions on small holdings remained the same as in April, improvement in upkeep and in treatment of bark diseases being maintained. The possible effect of the appearance of a holding on the assessment of its production may have influenced owners towards improving the condition of their properties. On the other hand, severe tapping has naturally resulted from the desire to obtain as large a crop as possible at the present satisfactory prices, before the enforcement of export quotas puts an end to unrestrained production.

In Kelantan, the production of fairly clean and dry sheet rubber in preference to wet and dirty slab is making good progress, while the erection of small smoke houses by certain individuals is another step forward.

Padi.—The price of padi at the Government Rice Mill, Bagan Serai, remained at $1.40 per picul, while a private mill paid $1.30 per picul. The

price in Kedah improved somewhat and was equivalent to approximately $1.05 to $1.10 in Kota Star District, while in the Province the range was about 90 cents to $1.25 per picul.

The padi harvest was practically completed everywhere. Estimates made by the Department of Agriculture in Kedah showed that from an area of some 238,460 acres planted with wet padi an excellent crop of about 93,117,000 gantangs was reaped. This is a considerable increase both in planted area and total crop over the record figures for the previous season which in respect of wet padi were 219,010 acres and 74,366,000 gantangs.

In Kuantan District of Pahang, the yield per acre was estimated to be only 180 gantangs. This was probably due to inferior cultivation and lack of attention to weeding, since on the Sungei Blat Padi Test Plot the average yield per acre was nearly twice the figure for the District.

In Malacca, local distribution of selected padi seed has been completed and has amounted to 3,800 gantangs. The demand has been so heavy that part of it has had to remain unsatisfied owing to exhaustion of stocks. It is evident that the selected strains of the local Nachin and Siam padi are rapidly gaining in popularity among cultivators. An application has also been received from one district in Johore for seed of the same selected strains. It is hoped to supply this from Test Plots in other States.

Coconuts and Copra.—The average price of copra showed a slight improvement, ranging in different localities from $1 to $3 per picul. The Singapore price was about $2.40 as compared with $2.30 per picul in April.

In spite of the discouraging effect of the low price, the erection of kilns of the approved type for making copra of good quality continued in various parts of the country. In the Province one more such kiln commenced production, while in Krian three kilns were in operation and a fourth was under construction. In Kelantan a brick kiln was completed and produced copra of good quality. The new kiln built with the aid of Government at Sri Menanti in the Muar District of Johore was formally opened by the State Commissioner; the first copra produced reached a high standard. If the quality of commercial consignments is maintained at that of the first sample, the product is likely to command the top price in Singapore.

In eastern Pahang, one brick kiln has been completed, while in Pulau Tioman three kilns are in course of construction as a result of recent propaganda work in that island.

It is reported that copra in the Bagan Datoh District shows improvement generally. This is attributed in part to the effect of the propaganda work carried out during the visit of the Rural Lecture Caravan and in part to greater discrimination by certain local buyers.

The State Agricultural Officer, Selangor, reports that as a result of the construction of a bund by the Drainage and Irrigation Department to keep out sea water in the mukim of Bagan Nakhoda Omar, yields from coconut palms in that area have shown a marked increase and are now high.

Pineapples.—Heavy crops of fruit were obtained during the month in Selangor, Johore and Singapore Island. In Selangor the second factory commenced working again, in Johore eight factories were working, while in Singapore all the factories were working at high pressure. Prices for fresh fruits in Johore were:—first quality $1.20 to $1.50, second quality 90 cents to $1.20, third quality 60 to 90 cents per hundred. Corresponding prices in Singapore were $1.80 and 80 cents per hundred for first and second quality fruits. In Selangor prices ranged from 70 cents to $1.10 per hundred for large fruit, all fruits below a standard size being counted as half fruits only. From one area on the coast of Selangor fruits were being sold direct to Singapore at $1.80 per hundred.

Fruit.—Durians and mangosteens appeared on the markets in several parts of the conutry. Ripe fruits were obtained more especially in the Settlement of Penang, Larut District of Perak and Batu Pahat District of Johore, although in the latter the crops were poor. In fact, judging by the appearance of the trees, the general fruit crop throughout Johore will be very poor this season. Durians sold at weekly fairs in Krian from Larut District fetched from 5 to 12 cents each. A crop of mangoes and machangs was being harvested in Western Pahang and mangoes from Malacca were being exported to the market in Kuala Lumpur.

Coffee.—A heavy crop of coffee was being harvested in the Kuala Langat District of Selangor. Unfortunately Malays who prepare their own beans of reasonably good quality have been unable to find a market for their produce at reasonable prices and may be forced to revert to the practice of selling cherry to local middlemen for preparation. Coffee prepared by Malays in Kuala Selangor District is sold in various villages in the District and also at times in Klang and in Ulu Selangor District.

Local prices for coffee beans have ranged from $16 to $32 per picul in various parts of the country.

Tapioca.—Interest in the cultivation of this crop in Kedah has been well maintained and some 530 acres have recently been planted. In Malacca also a considerable increase in the planted area has resulted from the erection of a factory at Durian Tunggal. In Negri Sembilan 150 acres of tapioca have recently been planted and two factories, each with an output of about 700 piculs per mensem, are operating in Tampin District.

On the other hand, the area of tapioca interplanted with rubber in Segamat and Kluang Districts of Johore is decreasing rapidly as the rubber becomes mature, and factories are experiencing difficulty in obtaining sufficient supplies of root.

Tobacco.—Prices of sun-dried leaves have varied between $8 and $36 per picul in most parts of the country according to quality, but in Malacca the range was $28 to $50 and in Johore $30 to $70.

The high price in Johore is mainly due to the fact that all supplies of leaf are drawn from the Segamat District, growers elsewhere in the State having been discouraged by the damage occasioned fairly recently by floods or by the uncertainty of finding a market for their produce from previous crops. The result is now a considerable extension of the planted area in Segamat District.

In Kedah some 230 acres of tobacco have recently been planted, tobacco in Baling District being frequently grown as an intermediate crop on padi land. There is also a considerable area of tobacco in Perak.

Kapok.—Fairly considerable quanties of kapok were sold in local markets in Western Pahang at $12 to $14 for cleaned floss, a satisfactory price. There were some good exhibits of cleaned kapok at the Temerloh Agricultural Show. Prices in Eastern Pahang were 7 to 9 cents per kati for uncleaned kapok.

Agricultural Stations.

At the Central Station, Kota Bahru, Kelantan, poultry keeping was commenced with twelve Rhode Island Red Pullets obtained from the Pulau Gadong Station in Malacca, where there are now a fair number of young birds of various ages of both the Rhode Island Red and Light Sussex breeds. These have been produced locally from the stock imported from England last year.

Padi Stations and Test Plots.

Cultivation was commenced and nurseries were sown at the Pulau Gadong Station in Malacca. Work was in the same stage at five Padi Test Plots in other parts of the country, while transplanting was in progress on the two inland Test Plots in Selangor.

At the Sungei Blat Test Plot, Kuantan, Pahang, yields obtained were as follows:—Chendar, a local variety, 435 gantangs; Nachin 66, 320 gantangs; Siam 29, 303 gantangs; Siam 76, 302 gantangs; and Seraup 36, 296 gantangs per acre. These yields were approximately double the local average yield.

From the Telok Changai Station and local Padi Test Plots in Kedah fourteen pure strains were distributed for planting, eight being local selections and six being selections from Malacca and Krian. These are the strains approved for next year's Malayan Padi Competition and their distribution was accompanied by instruction work.

Rural Lecture Caravan.

The Caravan visited five centres in Province Wellesley from May 4th. to 13th. and six centres in Krian from May 14th. to 25th. The subjects dealt with were mainly poultry keeping and improved copra production. Both tours were quite successful.

Refresher Course for Malay Officers.

A Refresher Course for Malay Officers of this Department was held at the School of Agriculture, Malaya, and the Central Experiment Station, Serdang, from April 30th. to May 4th. Instruction was given on poultry, vegetative methods of reproduction, nursery work, and general work on tea and coffee. Certain officers spent one day at the Klang Coconut Station where demonstrations of the approved copra kiln and the method of making good copra were given.

DEPARTMENTAL NOTES.

Visits of Director of Agriculture.

The Director of Agriculture visited Klang, Bagan Datoh, Penang and Province Wellesley with the other members of the Vegetable Oils Committee, of which he is Chairman, on May 15 to 18 inclusive. Meetings of the Committee were held at each of the points mentioned.

Poultry Course.

The National Institute of Poultry Husbandry has arranged a Summer Course of Instruction of four weeks duration, for Colonial Officers on leave, at the Harper Adams Agricultural College, Newport, Shropshire, England.

Messrs. G. E. Mann, M.C., and F. R. Mason, both of this Department, will attend the course during their period of leave in England this year.

Visit to Java.

Mr. J. N. Milsum, Assistant Agriculturist, visited Java between 21 April and 7 May, 1934. The purpose of his tour was mainly to study the position in that country in relation to fruit cultivation, with special reference to methods of raising large quantities of stock for distribution.

He also took this opportunity of examining a number of crops, in particular the preparation of tea by Chinese methods.

Leave.

Mr. F. S. Banfield, Horticultural Assistant, has been granted 5 months and 4 days full-pay leave from 12 May 1934, before retirement on abolition of appointment.

Mr. F. R. Mason, Agricultural Field Officer, has been granted 7 months and 16 days full-pay leave from 16 May 1934 inclusive.

Mr. A. Thompson, Government Mycologist, has been granted 7 months and 8 days full-pay leave from 25 May 1934 inclusive.

Mr. J. Fairweather, Principal Agricultural Officer, Johore, returned from leave on 11 May 1934.

Statistical.

MARKET PRICES.

May, 1934.

Rubber.—The price of rubber reacted sharply to the official announcement on 30 April of an international rubber restriction agreement. The Singapore price for spot loose on that date was 21½ cents per lb.; thereafter the price continued to rise, until on 8 May it was 24¾ cents. The price then fell gradually and at the end of the month was 19¼ cents. The highest London and New York quotations during the month were 7¼ pence and 15 3/16 cents gold respectively. Average prices per lb. for the month were:—Singapore 21.35 cents, London 6.38 pence, New York 13.31 cents gold, as compared with 18.75 cents, 5.65 pence and 11.94 cents gold respectively in April.

Weekly prices during May for small-holders' rubber at three centres are shewn in Table II.

Palm Oil.—The course of the market is shewn in the following table. Basis 5 per cent. f.f.a.

Table I.

DATE	PALM OIL			KERNELS
	L'Pool/Holland/ Hamburg c. i. f. landed weights in bulk per ton £. s. d.	U.S.A. landed weight per lb. c. i. f. New York/ Philadelphia cents gold	L'Pool/Continent c. i. f. per ton net in barrels £. s. d.	Fair Average Malayan Quality c. i. f. Landed Weight per ton on Continent. £. s. d.
May 2	10 5 0	2.25	12 15 0	6 5 0
„ 9	10 10 0	2.25	12 15 0	6 10 0
„ 16	9 15 0	2.15	12 15 0	6 12 6
„ 23	9 15 0	—	12 10 0	6 12 6
„ 30	8 10 0	—	11 15 0	6 10 0

Copra.—The Singapore price of copra appreciated somewhat during the month, although there is no evidence of any real strengthening in the price. Sundried copra opened the month at $2.65 per picul, gradually improved to $2.90 by the middle of the month, at which price it remained till the end of the month. The average price per picul of this grade in May was $2.83 as

compared with $2.62 in April. The mixed quality averaged $2.35 per picul as compared with $2.15 in the previous month.

Copra cake was quoted throughout the month at $1 a picul.

Rice.—The average wholesale price of rice per picul during April was as follows :—Siam No. 2 (ordinary) $2.54, Rangoon No. 1 $2.42, Saigon No. 1 (long grain) $2.57, as compared with $2.82, $2.47, and $2.62 per picul respectively in March. Corresponding prices in April 1933 were :—$3.54, $2.95, and $3.22.

The average retail market prices in cents per gantang of No. 2 Siam rice in April were :—Singapore 23, Penang 25, Malacca 24, as compared with 23, 26, and 24 respectively in March.

Table II.

Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, May 1934.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.				Kuala Kangsar, Perak.			Batu Pahat Johore.				
	3.5.34	10.5.34	17.5.34	24.5.34	2.5.34	9.5.34	16.5.34	2.5.34	9.5.34	7.5.34	23.5.34	25.4.34
Smoked sheet	29.00	27.59	24.89	24.00				27.80	24.58	22.18	22.06	21.00
Unsmoked sheet	24.70	24.41	20.00	17.46						18.00		16.73
Rubber*					25.00	18.34	20.00	8.73	9.53	5.90	6.19	5.30
Scrap	8.06	8.21	6.14	—								

*Wet unsmoked sheet.

Transport by lorry Kuala Pilah to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent.

No purchases at Kuala Pilah on 31st. May or at Kuala Kangsar on 23rd. and 30th. May.

Tea.—Malayan (Lowland) tea was quoted in London in April at 1s.0$\frac{3}{4}$d. per lb. Average London prices per lb. during April for tea consignments from other countries were as follows:—Ceylon 1s.2.98d., Java 1s.0.82d., Indian Northern 1s.2.07d., Indian Southern 1s.2.28d., Sumatra 1s.0.08d.

Tuba Root (Derris).—The Singapore market was essentially a sellers' market; in consequence prices shewed considerable marking up on the previous month's level. Rotenone-containing roots averaged $37 per picul, while roots sold on the ether-extract basis averaged $28.50 per picul, the advances being $4.50 and $2.50 per picul respectively during May.

Coffee.—The Singapore price of Sourabaya coffee remained steady; prices ranged according to grade from $20 to $21 per picul. Palembang coffee averaged $16.19 per picul, as compared with $17.19 in April.

Arecanuts.—Average prices per picul in Singapore were as follows:—Splits, $2.67 to $4; Sliced, $7.19 to $11.69; Red Whole $2.95 to $4.15; Sourabaya Whole, $3.62 to $5.50; Kelantan Whole, $3.47 to $3.71, the price within each range depending upon quality. There were no arrivals of Bila Whole. Average prices per picul quoted by the Singapore Chamber of Commerce were:—Best $4.16, Medium $3.56, Mixed $3.07.

Gambier. Singapore prices shew some improvement over those ruling at the end of April. Average prices per picul in May were, Block $4.25, Cube No. 1, $7.19 as compared with $3.81 and $6.75 respectively in April.

Pineapples.—Sellers were reserved in the earlier part of the month, but more business at slightly lower prices followed as the large crop being harvested came into the market. Singapore average prices per case in May were as follows:—Cubes $3.02, Sliced Flat $2.97, Sliced Tall $3.07 as compared with $3.02, $2.93 and $3.02 respectively in the previous month.

Tapioca.—Enquiry was good at the beginning of the month and prices advanced, but later the market became dull and featureless. Average prices per picul in Singapore during May were as follows:—Flake Fair $4.60, Pearl Seed $5.91, Pearl Medium $6.37, as compared with $4.19, $5.39 and $6 in April.

Sago.—The Singapore market exhibited features similar to that for tapioca. Average prices per picul in May were:—Pearl, Small Fair $4.76, Flour, Sarawak Fair $1.90; average prices in the previous month being $3.74 and $1.81 respectively.

Mace.—The Singapore market for mace and nutmegs was quiet throughout May. Quotations were steady, Siouw at $70 and Amboina at $50 per picul, as compared with $67.50 and $45 respectively in April.

Nutmegs.—On the Singapore market, 110's were quoted throughout May at $22.50, while 80's were $23 per picul. Corresponding average prices in April were $22.50 and $23.50.

Pepper.—The feature of the Singapore market was a sharp advance in price, said to be due largely to speculative manipulation in Europe. The price receded almost as sharply. The market closed with a steadier tone. Average

Singapore prices per picul in May were:—Singapore Black \$16.19, Singapore White \$34.75, Muntok White \$35.75, as compared with \$15.25, \$29.62, and \$30.12 respectively in April.

Cloves.—Singapore prices continue nominal at Zanzibar \$35 and Amboina \$45 per picul.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Mackey & Co., Singapore.

1 picul $= 133\frac{1}{3}$ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY.

April, 1934.

Malaya.—The foreign imports of rice in April amounted to 49,580 tons, exports for the month being 10,534 tons. Net imports were therefore 39,046 tons. The net imports for the first four months of 1934 were 148,309 tons, an increase of 17,626 tons, or 13.5 per cent. over the corresponding period of 1933.

Of the imports in April, 42 per cent. were consigned to Singapore, 23 per cent. to Penang, 6 per cent. to Malacca, 22 per cent. to the Federated Malay States and 7 per cent. to the Unfederated Malay States. Of the total, 52 per cent. came from Siam, 38 per cent. from Burma, 9 per cent. from French Indo-China and 1 per cent. from other countries.

Of the exports during April, 67 per cent. were shipped to Netherlands India and 33 per cent. to other countries. Of the various kinds of rice exported, 57 per cent. was Siam rice, 34 per cent. Burma rice, 4 per cent. Indo-China rice and 2 per cent. local production.

India and Burma.—Foreign exports in March amounted to 223,000 tons. For the first quarter 1934, the total exports were 698,000 tons as compared with 829,000 tons for the first three months of 1933.

Siam.—The exports of rice from Bangkok in April were 135,571 tons: total exports for the first four months of 1934 were 1,392,347 tons, as compared with 1,446,670 tons during the corresponding period of 1933.

Japan.—According to the Ministry for Agriculture and Forestry, (*Trans-Pacific Journal*, 12 April 1934) the stocks of rice in Japan proper on 1 March 1934 amounted to 7,582,600 tons.

The demand and supply of rice during the period 1 March, 1934 to 31 October, 1934, were estimated as follows:—

Supply:	Stock on 1.3.34	7,582,600 tons.
	Imports of Korean rice	666,200 „
	Imports of Formosan rice ...	375,900 „
	Imports of foreign rice	nil
Demand:	Eight months' consumption (Mar./Oct.)	6,336,600 tons.
	Export	43,500 „

shewing a surplus of 2,244,600 tons.

French Indo-China.—Entries of padi into Cholon, January to April amounted to 452,000 metric tons, as compared with 441,000 metric tons during the corresponding period of 1933, an increase of 2.5 per cent. Exports of rice January/April 1934, inclusive were 499,000 metric tons, compared with 502,000 metric tons for the period January/April 1933, a decrease of .6 per cent.

Netherlands India.—Latest available information published in the Summary for March 1934.

Ceylon.—The imports for the first four months of 1934 at 157,915 tons shew an increase of 19,896 tons, or 14.4 per cent. over imports for the corresponding period of 1933. Of 1934 imports, 16 per cent. were from British India, 66 per cent. from Burma and 18 per cent. from other countries.

Europe and America.—Shipments from the East to Europe from 1 January to 19 April, 1934, were 346,202 tons as compared with 458,268 tons for the corresponding period of 1933, a decrease of 24.5 per cent.

Of 1934 shipments, 38 per cent. were from Burma, nil from Japan, 43 per cent. from Saigon, 14 per cent. from Siam and 1 per cent. from Bengal, as compared with 44, 5, 42, 8 and 1 per cent. respectively in the corresponding period of 1933.

During the period 1 January to 26 March 1934, 12,325 tons were shipped from the East to the Levant, as compared with 9,457 tons for the same period in 1933; this is an increase of 30.3 per cent.

To the West Indies and America (1 January to 17 March, 1934) 30,200 tons were shipped from the East, as compared with 27,684 tons for the corresponding period of 1933, an increase in 1934 of 9.1 per cent.

MALAYAN AGRICULTURAL EXPORTS, APRIL, 1934.

PRODUCT.	Net Export in Tons.				
	Year 1933.	Jan.-Apl. 1933.	Jan.-Apl. 1934.	April 1933.	April 1934.
Arecanuts ...	20,756	7,949	12,547	2,443	2,798
Coconuts, fresh ...	100,609†	30,652†	31,485†	9,043†	9,833†
Coconut oil ...	17,568	6,312	8,331	1,676	2,080
Copra ...	110,543	29,160	33,329	8,258	5,830
Gambier, all kinds ...	2,560	749	693	156	134
Palm kernels ...	1,983	418	862	65	365
Palm oil ...	12,101	2,301	3,912	1,199	1,668
Pineapples canned ...	59,582	17,635	20,660	4,700	6,371
Rubber ...	459,836§	136,056§	163,901§	36,752§	39,484§
Sago,—flour ...	7,648	1,529	3,403	48	66*
„ —pearl ...	2,646	665	1,307	160	541
„ —raw ...	4,420*	1,373*	1,763*	295*	683*
Tapioca,—flake ...	9,881	4,135	2,972	1,080	800
„ —flour ...	702*	64	671*	28	139*
„ —pearl ...	17,297	5,600	5,246	2,135	1,471
Tuba root ...	569½	126	215½	46	65

† hundreds in number. * net imports. § production.

MALAYA RUBBER STATISTICS

Acreages of Tappable Rubber not Tapped on Estates of 100 Acres and over, for the Month ending April, 1934.

State or Territory	Acreage of Tappable Rubber end 1932 (d)	Estates which have entirely ceased tapping: Acreage	Estates which have entirely ceased tapping: Percentage of (3) to (2)	Estates which have partly ceased tapping: Acreage	Estates which have partly ceased tapping: Percentage of (5) to (2)	Area of Tappable Rubber never been tapped: Acreage	Area of Tappable Rubber never been tapped: Percentage of (7) to (2)	Total (3) + (5)	Percentage of (9) to (2)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Straits Settlements :—									
Province Wellesley	44,734	1,106	2.5	8,697	19.4	1,048	2.3	9,803	21.9
Dindings	6,969	115	1.6	1,366	19.6	516	7.4	1,481	21.2
Malacca	111,780	4,724	4.2	20,142	18.0	4,794	4.3	24,866	22.2
Penang Island	1,635	653	39.9	216	13.2	177	10.8	869	53.1
Singapore Island	28,269	5,437	19.2	4,857	17.2	540	1.9	10,294	36.4
Total S.S. ...	193,387	12,035	6.2	35,278	18.2	7,075	3.6	47,313	24.4
Federated Malay States :—									
Perak	250,951	4,744	1.9	39,653	15.8	13,395	5.3	44,397	17.7
Selangor	308,379	5,596	1.8	48,603	15.8	14,160	4.6	54,199	17.6
Negri Sembilan	228,541	6,867	3.0	37,405	16.4	15,793	6.9	44,272	19.4
Pahang	38,141	2,492	6.5	12,071	31.6	6,012	15.8	14,563	38.1
Total F.M.S. ...	826,012	19,699	2.4	137,732	16.7	49,360	6.0	157,431	19.1
Unfederated Malay States :—									
Johore	325,747	15,453	4.7	31,069	9.5	22,232	6.8	46,522	14.2
Kedah (a) (b)	126,588	10,292	8.1	12,704	10.0	15,574	12.3	22,996	18.1
Kelantan	21,176	1,680	7.9	4,619	21.8	4,163	19.7	6,299	29.7
Trengganu (c)	4,643	Nil	Nil	1,609	34.7	200	4.3	1,609	34.7
Perlis (a) (b)	957	159	16.6	192	20.0	318	33.2	351	36.6
Total U.M.S. ...	479,111	27,584	5.8	50,193	10.5	42,487	8.9	77,777	16.2
Total Malaya ...	1,498,510	59,318	4.0	223,203	14.9	98,922	6.6	282,521	18.9

Notes :—(*a*) Registered companies only and are rendered quarterly.

(*b*) The figures quoted for Kedah and Perlis are those for end December 1933, and Kelantan end January, 1934 Revised figures will be published when available.

(*c*) Registered Companies only.

(*d*) Figures for end December 1933, are not yet available.

(*e*) Estimated: figures not yet available.

MALAYA RUBBER STATISTICS TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF APRIL, 1934 IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month		
	Ports	Dealers	Estates of 100 acres and over	during the month	January to April inclusive 1934	during the month	January to April inclusive 1934	during the month: Foreign	during the month: From Malay States & Labuan	January to April inclusive 1934: Foreign	January to April inclusive 1934: From Malay States & Labuan	during the month: Foreign	during the month: Local	January to April inclusive 1934: Foreign	January to April inclusive 1934: Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States ...	...	16,339	9,813	10,613	45,348	9,794	42,286	Nil	Nil	Nil	Nil	14,066	9,479	62,427	27,584	...	14,254	8,742
Johore ...	...	3,404	3,054	3,759	14,524	5,420	19,329	Nil	3	Nil	16	1,796	7,271	6,570	27,213	...	3,694	2,879
Kedah ...	...	323	1,822	2,586	10,996	1,447	6,493	Nil	Nil	Nil	Nil	1,512	2,732	6,071	12,316	...	378	1,556
Perlis ...	...	14	14	8	51	38	147	Nil	Nil	Nil	Nil	Nil	27	Nil	194	...	27	20
Kelantan ...	...	809	124	224	889	430	3,408	Nil	Nil	319	Nil	109	925	369	4,112	...	389	164
Trengganu ...	...	55	50	246	865	123	431	Nil	Nil	Nil	Nil	Nil	369	Nil	1,296		55	50
Total Malay States	...	20,944	14,877	17,436	72,673	17,252	72,094	Nil	3	319	16	17,483	20,803	75,437	72,715	...	18,797	13,411
STRAITS SETTLEMENTS :-																		
Malacca ...	...	3,812	992	1,267	5,277			1		3		3,348		14,040		...	3,582	892
Province Wellesley	...	1,871	435	491	2,123			Nil		Nil						...	2,291	421
Dindings ...	...	74	133	94	420	2,759	10,582	Nil	16,554	Nil	66,597	8,726	Nil	34,080	Nil	...	77	103
Penang ...	1,090	6,928	6	7	44			2,036		8,125						1,777	7,002	4
Singapore ...	6,841	38,608	144	178	688			18,920		63,572		27,191		104,628		9,403	39,249	137
Total Straits Settlements	7,931	51,293	1,710	2,037	8,552	2,759	10,582	20,957	16,554	71,700	66,597	39,265	Nil	152,748	Nil	11,180	52,201	1,557
TOTAL MALAYA	7,931	72,237	16,587	19,473	81,225	20,011	82,676	20,957	16,557	72,019	66,613	56,748	20,803	228,185	72,715	11,180	0,998	14,968

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
20	21	22	23	24	25	26
DRY RUBBER	10,363	32,697	6,403	4,699	1,655	122
WET RUBBER	3,819	6,552	599	1,251	2,039	256
TOTAL ...	14,254	39,249	7,002	5,950	3,694	378

TABLE III
FOREIGN EXPORTS

PORTS	For month	January to April 1934
Singapore ...	37,741	147,278
Penang ...	12,951	53,242
Port Swettenham.	5,491	24,736
Malacca ...	565	2,929
MALAYA ...	56,748	228,185

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January to April 1934
Malay States ... Straits Settlements	36,316	159,760
MALAYA ...	36,316	159,760

Notes:—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month + Consumption, *i. e.*, Column [9] = Columns [15] + [16] + [19] + [20] + [21] + [22] —[4]—[5]—[6]—[7]—[11]—[12]. For the Straits Settlements, Columns [9] and [10] represent purchases by dealers from local estates of less than 100 acres, reduced by 15 % to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15;% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month.

5. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 26 May, 1934.

METEOROLOGICAL SUMMARY, MALAYA, APRIL, 1934.

Locality	Air Temperature in Degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes									Number of days							
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet	Total		Most in a day Amt.	Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.								
Railway Hill, Kuala Lumpur, Selangor ...	91.2	72.5	81.9	95	70	85	75	84.6	85.0	15.52	394.2	3.48	24	21	10	7		182.35	6.08	50
Bukit Jeram, Selangor ...	88.1	72.7	80.4	90	71	85	74	84.5	85.9	6.86	174.3	2.56	17	13	2	1	1	209.20	6.97	57
Sitiawan, Perak ...	89.0	72.9	80.9	91	71	78	75	84.1	84.7	3.32	84.3	1.37	20	10				209.25	6.97	57
Temerloh, Pahang ...	91.0	73.0	82.0	93	71	87	75	85.9	85.7	7.35	186.7	2.69	15	13				216.05	7.20	59
Kuala Lipis, Pahang ...	89.7	72.1	80.9	92	69	87	74	84.5	84.3	9.65	245.1	3.58	19	17	2	19		193.45	6.45	53
Kuala Pahang, Pahang ...	86.6	74.0	80.3	89	72	83	77	84.6	84.4	8.99	228.3	4.56	14	12	2			265.45	8.85	73
Mount Faber, Singapore ...	86.6	73.6	80.1	90	70	77	76	82.2	81.8	3.62	92.0	0.82	16	12	3			191.35	6.38	52
Butterworth, Province Wellesley ...	88.2	74.0	81.1	90	72	82	76	84.5	85.6	6.66	169.2	2.42	15	12	1			211.55	7.05	58
Bukit China, Malacca ...	85.4	73.9	79.7	91	72	83	76	83.7	83.7	4.31	109.5	2.69	12	8	1			200.85	6.69	56
Kluang, Johore ...	88.9	71.2	80.1	92	68	81	73	82.2	81.7	10.20	259.1	1.75	19	15	3	7	1	175.45	5.85	48
Bukit Lalang, Mersing, Johore	86.1	71.9	79.0	90	69	80	74	81.9	81.0	4.01	101.9	1.15	15	12		3		227.30	7.58	62
Alor Star, Kedah ...	90.2	73.1	81.7	94	68	85	76	86.1	85.5	8.40	213.4	2.20	18	16	17	5		231.95	7.73	63
Kota Bahru, Kelantan ...	89.1	72.6	80.9	92	65	84	75	83.9	83.6	4.41	112.0	2.50	10	7	2			277.00	9.23	76
Kuala Trengganu, Trengganu	88.1	72.2	80.1	91	68	85	75	84.0	83.9	3.27	83.1	0.93	7	6	2	4		278.30	9.28	76
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. Pahang ...	73.5	62.6	68.0	77	59	71	64	71.5	71.6	10.73	272.5	1.68	23	21	8	10		138.55	4.62	38
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72.5	56.1	64.3	76	49	69	62	69.2	69.1	12.91	327.9	1.56	26	24	1			109.85	3.66	30
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	71.6	59.8	65.7	75	57	67	62			13.76	394.5	2.31	26	24	1			125.30	4.18	34

Compiled from Returns supplied by the Meteorological Branch, Malaya